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A STUDY TO DETERMINE THE OPTIMAL STRATEGIC PLANNING PROCESS FOR CONTROLLING AND COORDINATING THE INHOUSE DEVELOPMENT OF AN INTEGRATED COMPUTER-SUPPORTED HOSPITAL INFORMATION SYSTEM

A Graduate Research Project

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This study examines Strategic Planning concepts and how they relate to the development of Hospital Information Systems. The author recommends that Strategic Planning methods be utilized in the development of Hospital Information Systems, and provides guidance on how to do so.

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CHAPTER I

INTRODUCTION

Background

This Graduate Research Project originated at Brooke Army Medical Center, Fort Sam Houston, Texas, where the author was completing residency requirements for a Master's Degree in Health Care Administration. Prior to arrival at the residency site, the resident had developed a personal interest in automated management information systems and strategic planning during the didactic phase of the program.

Shortly after arrival at the residency site, the resident became aware of the multitude of isolated, stand-alone computer applications within the facility. In discussion with the Automation Management Officer (AMO), it was learned that an even more dynamic application future was forecast for the facility, based on projected systems and documented user requirements. The AMO had gained command approval to establish an Automation Management Guidance Committee, whose membership was arbitrarily established and whose purpose was somewhat nebulous. Nevertheless, it was a step in the right direction towards introducing a decision-making process into management and control of computer applications in the institution.

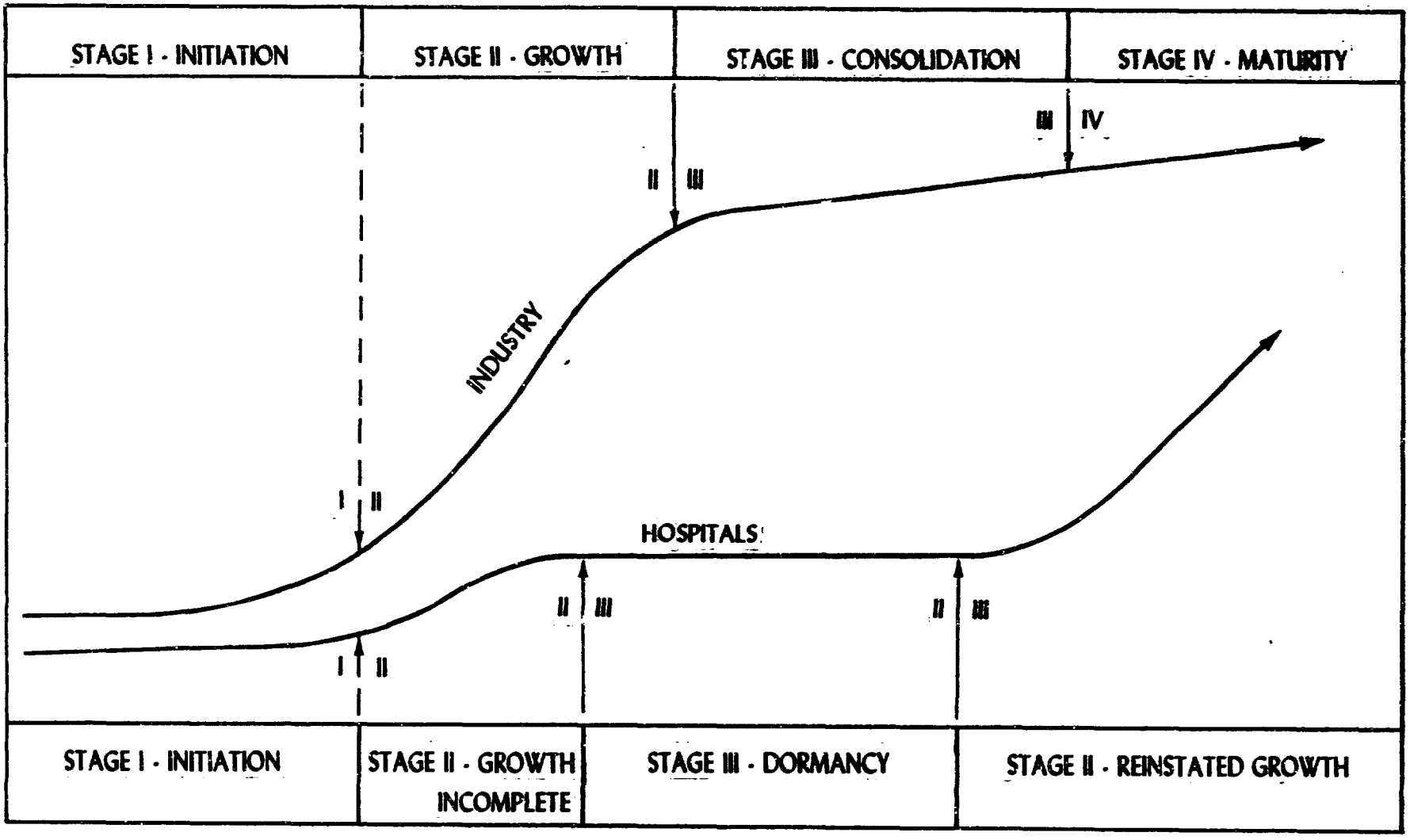
The initial question to the resident from the AMO concerned how the committee should function, or more specifically, how could a decision-making process be structured to produce the best plans for systems implementation?

Literature Review

Initially the question appeared easy to answer. A few hours of research into the literature of strategic planning, industrial management information systems and hospital information systems should lead to the discovery of an already documented importable process. Quite the opposite was found during initial research. It became apparent that the question was, in fact, a generic problem to the health care industry. Review of a variety of sources confirmed that while experts in the field all predicted and advocated medical information systems, none provided a methodology, process, or management sytem to get from wherever the institution was in computer implementation to that point.

The literature reviewed did agree that while two-thirds of the potential benefits from computer applications in hospitals were from patient care systems, only one-third of that potential had been realized, and only two-thirds of the potential benefit from administrative applications had been realized. This failure to maximize potential was most often attributed to deviation from the normal four-stage growth cycle associated with industrial applications (Fig. 1-1). The incomplete growth during Stage II for hospitals results from the hospital administration's perception that data processing, with its limited, mostly administrative applications at that point, is not achieving desired goals (cost effective). It is typical that, just when more funds are needed to achieve the successes of consolidation and maturity, the restraint of funds hastens failure and leads to a dormancy in systems development seen in Stage III. Hospital management's involvement in Stage III is minimal, limited mainly to exercising budgetary restraint and to replacing key data processing personnel. Major controls

THE FOUR STAGES OF DP GROWTH EXPERIENCED IN MOST ORGANIZATIONS



(Source: Richard L. Nolan, et al; Computer and Hospital Management: Prescription for Survival. p. 5)

Figure I - I

typically found in Stage III consolidation in other industries, but not in hospitals include: [1]

- Active involvement in planning the use of the systems and programming resources (inputs)
- Review of progress in relation to plans (output) (feedback)
- Requirement for standardized procedures as a basis for maintaining quality (transform)
- Establishment of measures for reviewing the effectiveness of data processing activities (control).

The outcome of the initial literature research can best be summarized by a quote from a 1980 article in Hospital Financial Management: "It might be important to mention here that as of the present there does not exist a single installation of what we would consider a total hospital information system, incorporating all of the possible modules currently existing in a variety of health care institutions."[2]

At this point in the development of the graduate project, it was obvious that no clear-cut importable process existed to answer the AMO's question. Additionally, what process, patterned after and designed to achieve the desirable results of similar growth in industrial concerns, could be developed to manage a health care institution through completed second and third stage growth?

The objectives of this research were formalized in the following problem statement: A graduate research project to determine the optimal design of a strategic planning process to control and coordinate inhouse development of computer-supported hospital information systems.

The key words are strategic, planning, and process. This paper does not discuss the architecture or technology of computer hardware,

the design of industrial computer applications, or the networking of distributed data processing. The sole purpose is to establish a management process for decision making by any health care institution seeking the optimal answers within their own environmental forces, for implementing a hospital information system.

The author is fully cognizant of the scope and ambitiousness of this research. In retrospect, the question might have been better reserved for doctoral research. Criticism based upon lack of depth, or failure to consider all available techniques is accepted in light of the abbreviated time limiting this study. Additionally, the author's experience in health care and academic background qualify him at best as a generalist in the profession of health care administration. No expertise in strategic planning, computer technology or management is claimed.

Research Methodology

As a generalist, the author has learned to rely on the general system theory approach to problem solving. The research methodology for this project is structured according to that theory. Direct and indirect research using discovery techniques will be used to research the well-documented disciplines of strategic planning and information systems. The premise is that, while each discipline has its own unique process, there are common concepts, characteristics, components, and elements. Once identified, the common components can be further examined for the detailed elements and steps which give form to the theoretical process of each. A recurring data analysis matrix will be used to extract the common elements for each component. Analog and conceptual models will be used to show the holistic process.

The output of the above research will be integrated with the existing literature on various aspects of hospital information systems using the same techniques. The object will be to structure the data into a model describing a strategic planning process for the optimal development of an integrated hospital information system. A secondary though uncommitted objective of this research is to identify those components and elements which can be given value either in time or relativity, then express that value relationship by an appropriate quantitative technique. Preliminary research indicated that the process used in strategic planning and the development of industrial information systems frequently used project (process) evaluation and review techniques (PERT) to express these value relationships.

The criteria by which this research project should be evaluated are:

- A strategic planning process for a hospital information system (HIS) must incorporate components commonly used in corporate strategic planning processes and industrial management information systems
- A HIS strategic planning process must be integrated into the existing organizational structure and management process
- A HIS strategic planning process must involve input from top managers, prospective users and technical experts in the field of automation
- A HIS strategic planning process must incorporate existing automated systems, technological change and projected organizational needs into an integrated system.

A brief discussion of the systems approach to problem solving is appropriate here, and will serve to orient the reader on the presentation format used in the discussion chapters that follow.

The systems thinking approach to problem solving holds that all systems are holistic. Every system is made up of separate but actively interrelated components which can be micro examined but which must be considered in the macro perspective. The theory further postulates that all systems have five basic and consistently common components. They are: inputs, outputs, transforms (or process), feedback, and an environment which influences the way the system functions. A special category of system theory, and the category with which this research deals, is information systems. In addition to the five common general system components, information systems have a cybernetic aspect. A feedforward component is added to the existing feedback component, providing for cybernetic control of the entire system.

Footnotes

[1]William E. Bowen, Strategies for Managing the Evaluation of Computer Technology in Hospitals (Lexington, Mass.: DP Management Corp., 1976), pp. 10-20.

[2]Marion J. Ball, Ed. and Thomas J. Boyle, Jr., "Hospital Information Systems: Past, Present, and Future," Hospital Financial Management, 32:2 (Feb 1980): 18.

CHAPTER II

STRATEGIC PLANNING

What

Strategic planning has an ominous, militaristic connotation to many managers. Perhaps that is why so few hospital administrators engage in strategic planning. The concept is cerebrally dismissed as being too rigid, formal and disciplined for the collegial, consultative environment of a hospital.

When defined separately, the concept is less threatening and easier to understand. Strategy simply sums up the pattern of decisions made by management which reveal its goals for the future and its objectives in regard to resource utilization and the environment, over time. Without strategy, unified organizational direction is virtually impossible. Strategies are made up of several alternatives conditioned by the probability of future events in the environment. It is important to distinguish that the set of alternatives are plans, an output of planning which is a process.

Strategic planning is a continual process of examining future alternative courses of action and making risk-taking decisions systematically. When formalized, the system has an organized structure, and the process has well-developed procedures or components. The structure of the system is hierarchied in that intermediate or medium range plans derive from strategic plans, and short range or operating policy and procedures derive from intermediate plans. The future orientation of

strategic planning makes it cyclical or iterative. As the probability of future events becomes certain, alternatives are exercised or modified. The feedback provided by the passage of time and events facilitates control, plans are changed, and the cycle is reinitiated.[1]

Why

If not inherently conveyed in the definition of strategic planning, the obvious question is "Why plan strategically?" Perhaps most salient is that the process of strategic planning becomes a vehicle for coordinated, effective communication up and down the organization. Certainly these are benefits which apply to the extensive lateral communication common in hospitals.

Strategic planning requires commitment by top management to support the plan(s) by allocating adequate resources to execute the plan(s). Similarly, strategic planning fences or constrains resources by narrowing and defining the alternatives or plans to be implemented. The internal forces generated by parochial power bases can, therefore, be controlled with a systematic holistic process.[2]

Strategic planning provides both positive direction by means of goals and negative guidance in the form of restraints. Levels of confidence improve with the knowledge that goals can be achieved without undue division of effort or resources. High priority goals are more likely to receive the action and support required.

Most significantly, the strategic planning process forecasts and manages change rather than reacting to it. Strategic planning provides an apriori process for identifying alternatives, determining their future impact on the institution, and committing resources to maximize the benefits of available alternatives.

Strategic planning is a threatening concept but can be a powerful tool for hospital managers. Like any powerful tool, it must be used properly, not modified for unintended applications. The literature in this discipline is extensive and mature, having evolved from the strategic planning processes used by the military 40 years ago.[3] What then are the components which comprise this powerful tool?

Systems Approach

The introduction stated that this research paper was structured according to a special category of general systems theory identified as information systems, and organized according to the basic components of that system: environment; inputs; transform (or process); output; and feedforward, feedback, and control (known as cybernetics).

Environment

In order for any biological system to exist, it must have a supportive, compatible environment in which to grow. A system of strategic planning is no different. The organizational environment must be more than just supportive. Frequently in the initiation of strategic planning, the environment must be nurturant if not forceful. The absolute commitment to a strategic planning process by top management must be clearly and repetitively communicated to every level of the organization. Resistance and artificial obstacles must be anticipated and removed. A climate for planning must be established that precipitates participation to the point where planning is an automatic function for every individual in the institution.[4]

Inputs

Just as the human body must receive a stimulus (input) for its various components to function, the strategic planning process must

receive inputs from top management for the system to function.

Inputs in the form of broad goals and objectives must be established for the institution by top management. Goals and objectives stipulate the desired or needed result from the business or an element of it. Although they are future oriented, a time frame for accomplishment must be established. A strategic planning time frame is most commonly five to six years, and longer if events beyond can be forecast with acceptable certainty (risk). Several organization techniques exist for establishing goals and objectives. The best techniques are normally those already existing within the established institutional management process. Management by objective is a common technique of establishing goals and objectives for many health care organizations today. Delphi, brainstorming, or management-directed goal setting are other techniques.

Regardless of the techniques, the appropriateness of goals and objectives should be judged by several well-established criteria. First, they should be reasonable, appropriate, and acceptable in the context of the institution's internal and external social, political, and economic environment. They should be stated as precisely as possible, preferably in quantifiable terms. A delicate balance between challenging and achievable must be struck. Goals and objectives should show a linking or networking to enhance perception and understanding of the desired direction or outcomes by top management. Taken collectively, the set of goals and objectives paints a mental picture of where management wants to be by a specified future date.[5]

The second element of the input component is the structure of the planning process. Management must decide who in the organization will do the planning. The literature here is consistent and pointedly

redundant. Planning must involve top management, middle management, and workers or users of the planning output. Within each level, individuals with the appropriate technical expertise, organizational knowledge and power must be involved.

Next, top management must allocate time to the people designated to perform the planning process. The range of options here is full-time, specified periods at established intervals, to part-time, as-needed intervals. The key is the perceived importance and sense of urgency for strategic planning by top management.

Finally, the planning structure must have an established format. The options range from a committee process to iterative staffing procedures. The midpoint would center around group process decision-making techniques found in management processes facilitated by organizational development (OD) personnel. Once again, the key here is congruance with existing formats in other areas of the organization's management. It is unlikely that a committee process would be productive in an environment where other committee formats are known to be time consuming and generally unproductive.

Feedforward

The next component of strategic planning is feedforward, elements of which can be either inherent in the system or provided externally to the system, or both. Regardless of the source mix of feedforward information, the elementary purpose is to forecast both the internal and external forces impacting on the institution with as great a degree of certainty as possible, as far into the future as can be forecast within an acceptable range of certainty (risk). The inverse relationship which exists between the out years of forecasting and certainty is

frequently compounded by the historically known rate of change for any given element forecasted.

Feedforward for strategic planning systems must, as a minimum, forecast the economic, social, political, and technological forces impacting on the organization.[6] Each forecasting discipline has its own body of well-developed literature not appropriate to discussion in this paper. A generic process model common to all forecasting techniques is shown at Fig. 2-1.

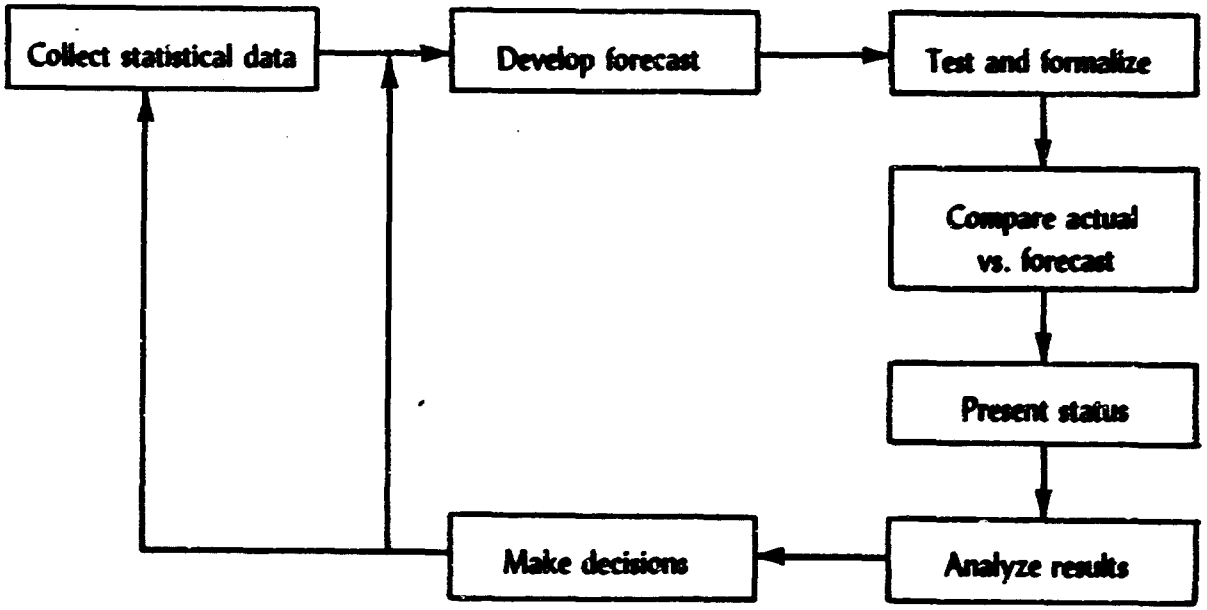
Another technique of the feedforward component is known as a situation audit, sometimes called gap analysis. The results of forecasts are compared against past performance and an assessment is made of potential performance compared to expected or strategic plan performance. The resultant gap between potential and expected can be analyzed in detail for determination of resource requirements necessary to close the gap.[7]

As was stated, these feedforward elements can either be provided by individuals within the organization not involved in the strategic planning process, or by personnel resources within the planning system. The essential point to be made here is that feedforward is a critical component of the strategic planning system. It is virtually impossible to efficiently arrive at where one wants to be if the present location is uncertain, no knowledge of what lies ahead is available, nor have the available and required resources for the trip been identified or obligated.

Transform

In the previous discussion of planning structure as an element of the input component, the requirement for deciding who actually accomplishes

FORECASTING LOOP



(Source: Paul Siegal; Strategic Planning of Management Information Systems, p. 93)

Figure 2 - 1

the planning was suggested. The importance of that single decision to the whole process is nowhere more obvious than in the transform or process component. It is within this component that the very best, broadest range of minds available to the organization must use the inputs provided and the feedforward data to identify all alternative courses of action. Participants must be capable of putting aside subjective thinking, personal basis and self-serving interests. All reasonable alternatives must be identified. Frequently the best alternative is, in fact, the least obvious, and only dedicated objectivity will permit the not-so-obvious to surface. Moreover, the problem is frequently to limit the number of alternatives, a difficult process when self-serving interests are involved.

The transform component must then proceed in a systemic course of evaluating alternatives using criteria derived from the input and feedforward components. Evaluation of alternatives must be given adequate time so as not to clip the decision-making process short of complete and critical analysis. Time may be required to complete the fact finding or specific studies in order to objectively evaluate the alternatives. Feasibility testing may be required. It is important to recall here that a basic characteristic of strategic planning is its iterative nature. The process can be expected to retrace steps, jump around from step to step and appear to be a tentative, trial-and-error process.[8] In perspective, it should be noted that the output of the process component will be used to guide the organization for at least the next five to seven years. Several weeks or even months are not too much to invest in the completion of this component. The transform will be complete

when the participants have selected a course of action made up of projected or sequence alternatives.

At this point in a strategic planning system, the literature is divided between the next step being an element of the transform component, or a separate function, external to the strategic planning system. The first argument is that derivative or implementing plans for each alternative should be established as an inherent element of the transform component. The other argument holds that strategic planning is hierarchial and that the formation of such plans is an intermediate or short-term, not strategic planning function. It is clear that, if the latter is chosen, then an element of the output from the transform component must be specific assignment of responsibility to appropriate operating entities within the organization to develop detailed implementing plans by a specified future date.

Output

The next component of the strategic planning system has already been suggested. Not withstanding the arguments on preparation of detailed implementing plans, the completion of a sequenced set of alternatives in fact becomes the next component, output.

The content of output is more important than the format. Content must be detailed as to what is to be accomplished by whom, by when, using specified resources and procedures if appropriate. The output content should include criteria for measuring progress towards accomplishing the alternative(s) and/or some other indication of accomplishment (reports, milestones, etc.). Ownership of responsibility to effect the alternatives must be clearly communicated not only to the responsible person(s), but throughout the organization for coordination purposes to preclude

duplication of effort or gaps and shortfalls in overall accomplishments of the strategic plans.

The format of the output (it can now be called the strategic plan) is best designed when integrated into the other existing communication structures in the institution. Regardless of format, it must be a written document, approved or indorsed in writing by top management prior to implementation. If the transform component were in fact given adequate time as discussed earlier, the content of the output should not come as a surprise to top management, and, thus, no major component changes should be directed at this point. Given the iterative, cybernetic characteristics of a strategic planning system, changes to the output should only be accomplished within the systems framework after a complete analysis of the feedback.

Cybernetics

Feedback is the last individual component of a strategic planning system. Feedback, when combined with feedforward, generates information such that when action is taken, control is accomplished and the cybernetic characteristics of the system are effected.

Many reasons why strategic planning fails to accomplish its goals and objectives are cited in the literature. The most common symptoms of feedback are that plans are not accomplished in the time frame provided. This can be caused by many factors, but the first place to look is in the feedforward component. Forecasting is not an exact science. Unexpected events may occur in either the external or internal environment which severely influence the original forecasts. It is possible that inappropriate techniques or risk values were used to predict the certainty of future events.

Similarly, the environment should be restudied. Perhaps over time, initial commitment by top management has waned due to interim crisis. Goals and objectives must be reexamined. Perhaps the strategic planning process has provided an outstanding solution for the wrong goals and objectives. Rethink the transform (process) component. Was there a lack of critical participation, or simply support? [9] The overriding concept when feedback is negative is that strategic planning is a system. Like a human system, the functioning of any one component can and does affect the function of one or more other components. Changes anywhere are propagated throughout the entire system. It all must work together to be congruent. Avoid fixing the first glitch discovered, then hoping that will solve the problem. While they respond to regulation, systems also become entropic.

The data analysis matrix (Fig. 2-2) outlines the components and key elements presented thus far. The bibliography can be consulted by title for the various strategic planning literature sources used to extract the content of Fig. 2-2. Fig. 2-3 presents a systems model of the entire strategic planning process. An excellent analog model which depicts the flow and sequencing of events was found in the seventh edition of Management by Koontz, O'Donnell, and Weihrich.[10] It is reproduced at Fig. 2-4.

Applicability

The target audience for this research paper are health care administrators. At this point, there may be skepticism that strategic planning of any sort can succeed in their environments, especially in the Not-for-Profit (NFP) sector of that environment.

STRATEGIC PLANNING DATA ANALYSIS MATRIX

Components	Elements
Environment	Preception Commitment Initiation Force
Inputs	Goals & Objectives Reasonable Appropriate Precise Quantifiable Challenging Achievable Linking Planning Structure Who Time How
Feedforward	Forecasting External Environment Internal Environment Economic, Social, Political, Technology Forces Gap Analysis
Transform (process)	Alternatives Evaluations Time Course of Action Sequenced Alternatives Written Documents Implementing Plans
Output	Content Format
Cybernetics	Feedback Performance Standards Reports Criteria Feedforward Systematic Analysis Action (Control)

Figure 2-2

STRATEGIC PLANNING SYSTEMS

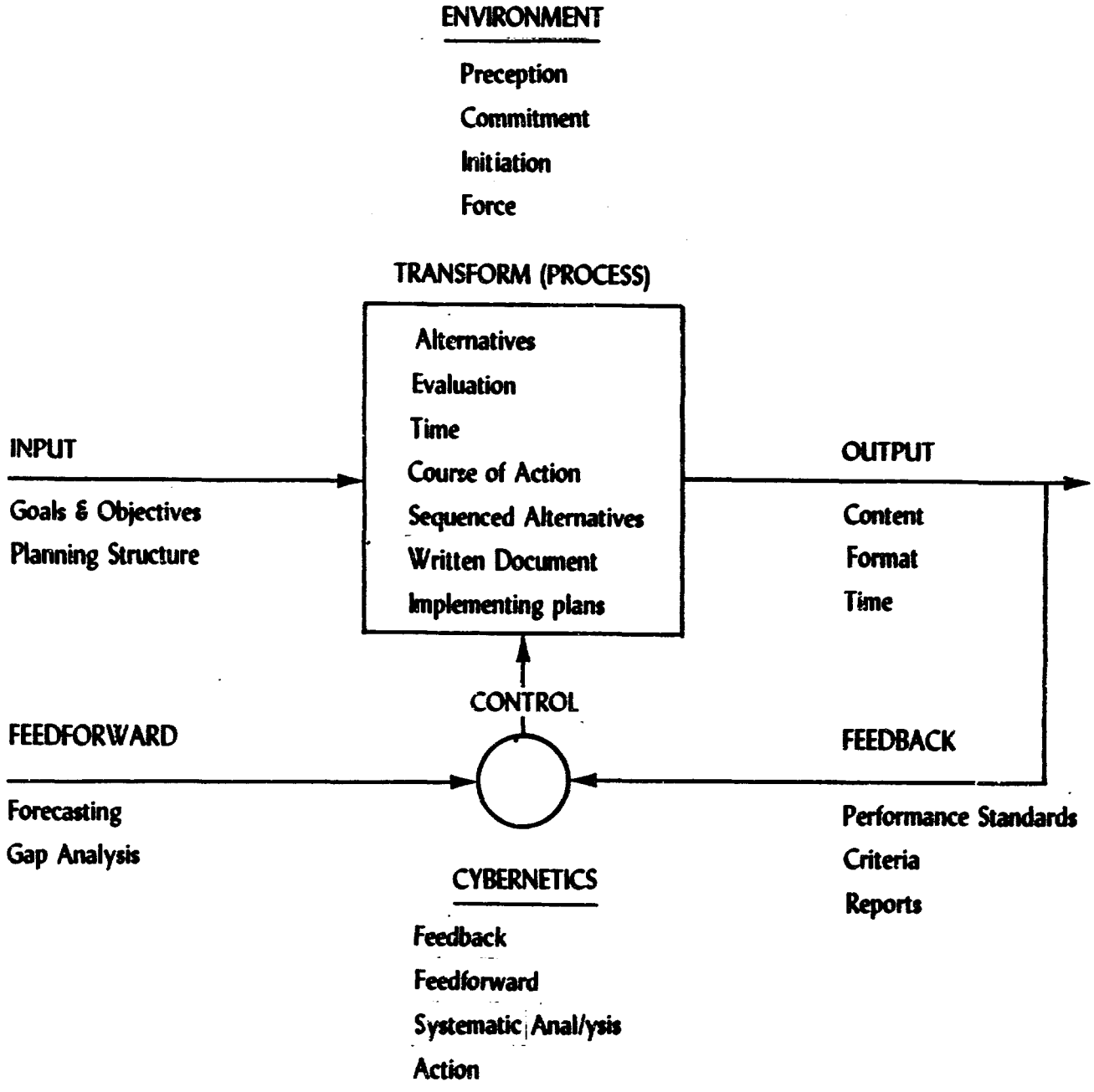
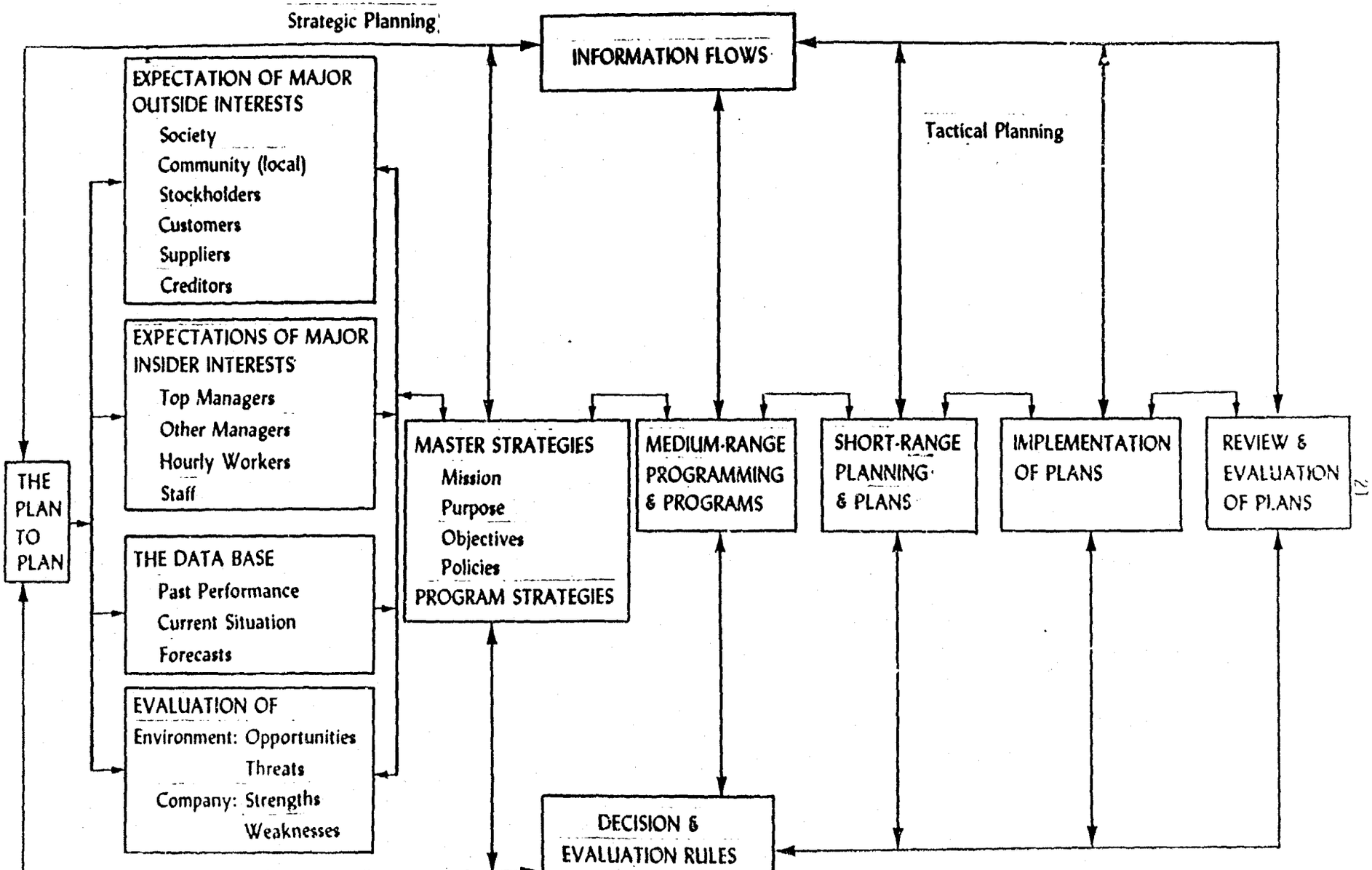


Figure 2 - 3

STRUCTURE AND PROCESS OF BUSINESS COMPANYWIDE PLANNING



(Source: George A. Steiner; Strategic Planning, (1979), p. 17)

Figure 2 - 4

During the course of this research, literature was found which addressed that very issue, and it is appropriate to discuss it here. Several forces in the NFP sector have considerably more impact than they do in the for-profit area. Government and politics dominate much of the decision making. Therefore, the political, social, and economic aspects of planning are subject to large-scale conceptual changes in accordance with election cycles. Pluralism, where patients and staff are also on the hospital board of directors or members of the Health Systems Agency Board, is common in the health care industry. Qualitative values (service) are more often the performance standards in the NFP institution, whereas quantitative values (profit) are preeminent in the for-profit area. Alternatives and decision making are, therefore, much more difficult in the Not-for-Profit sector.

There are, however, several overarching lessons and benefits from strategic planning in private industry which made a strong case for strategic planning in the NFP area. The most significant benefit is that strategic planning introduces a process. It is a way of identifying, analyzing, and resolving problems or initiating alternatives. The process is more important than the specific plan. There is no one right system, method, or process for strategic planning. A hospital must consider its strengths and weaknesses, then tailor a system best suited to its organization. Equally important is the idea that strategic planning develops appropriate strategies for adapting the organization to its environment.[11]

In the words of an illustrious professor who once taught this author and resident, "It's better to be approximately right, than precisely wrong." It is better to have a strategic plan to steer the

ship which must be frequently modified as a result of changes in the environment, than to drift rudderless in a sea of situational, capricious decision making.

Footnotes

[1]See Richard D. Irwin, The Concept of Corporate Strategy (New York: Richard D. Irwin, Inc., 1980), pp. 18-41; 162-169; Harold Koontz, Cyril O'Donnell, and Heinz Weihrich, Management, 7th ed. (New York: McGraw-Hill Book Co., 1980), pp. 8-16; Robert V. Head, Strategic Planning for Information Systems (Wellesley, Mass.: Q.E.D. Information Systems, Inc., 1979), pp. 18-24; George A. Steiner, Top Management Planning (New York: MacMillan Pub. Co., 1969), pp. 6-26; and Paul Siegal, Strategic Planning of Management Information Systems (New York: Petrocelli Books, 1975), pp. 34-37.

[2]George A. Steiner, Strategic Planning (New York: MacMillian Pub. Co., 1979), p. 6.

[3]Steiner, Top Management Planning, p. 6.

[4]See Kristin Anundsen, ed., Planning: New Tools and Perspectives (Chicago: American Management Assn., 1974), pp. 2-6; and Koontz, O'Donnell, and Weihrich, Management, pp. 179-185, 304-311.

[5]See Steiner, Strategic Planning, pp. 164-179; and Steiner, Top Management Planning, pp. 193-195.

[6]See Koontz, O'Donnell, and Weihrich, Management, pp. 219-225, and Siegal, Strategic Planning of Management Information Systems, pp. 86-101.

[7]See Steiner, Strategic Planning, pp. 122-129; Siegal, Strategic Planning of Management Information Systems, pp. 30-38; and Koontz, O'Donnell, and Weihrich, Management, pp. 283-284.

[8]See Koontz, O'Donnell, and Weihrich, Management, pp. 173-178; Steiner, Top Management Planning, pp. 36-39, 47-49, 137-138; and Siegel, Strategic Planning of Management Information Systems, pp. 42-45.

[9]See Anundsen, Planning: New Tools and Perspectives, pp. 21-26; Steiner, Strategic Planning, pp. 44-58, 290-298; Steiner, Top Management Planning, pp. 75-83, 720-725; and Koontz, O'Donnell, and Weihrich, Management, pp. 297-304.

[10]Koontz, O'Donnell, and Weihrich, Management, p. 17.

[11]Steiner, Strategic Planning, pp. 335-339.

CHAPTER III

MANAGEMENT INFORMATION STRATEGIC PLANNING SYSTEM

What

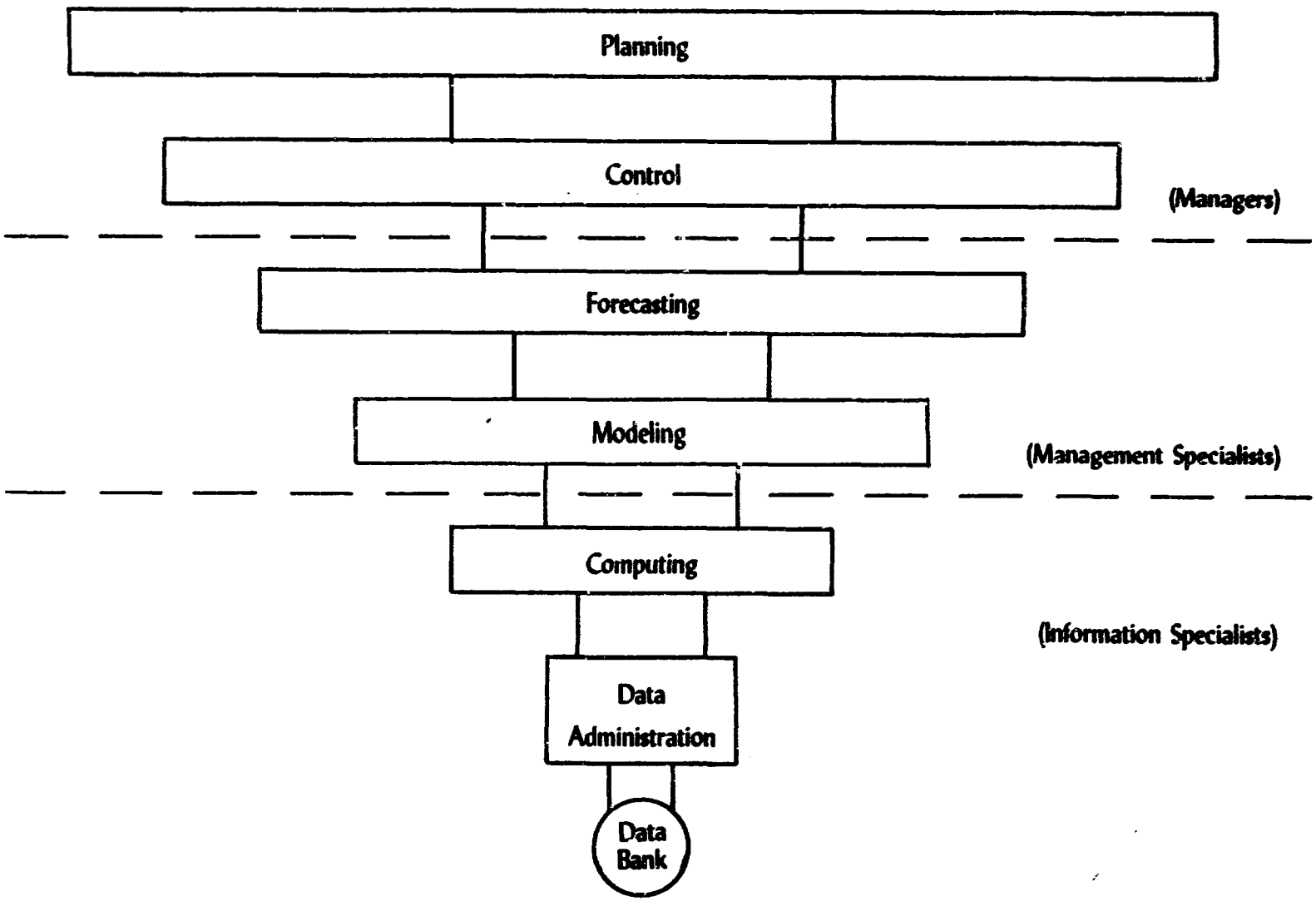
Before discussing the common components and elements of management information strategic planning systems, just what a management information system is should be defined clearly. The process will also serve to reconfirm the scope of this research project.

The literature describes three basic concepts which identify a management information system. First, there must be a means of recording random, haphazard events which occur in the routine conduct of the institution's activities. These events or data are normally recorded in digital form, however, individually the data have no meaning. They form a data base for the next concept, that of information.

When the data are selectively and purposefully organized, associated and displayed according to a predetermined pattern for a specific purpose, the data become information. The nature and intended use of the predetermined, purposeful patterns which organize information out of data constitute the last concept, that of a management information system.[1]

When management establishes purposeful patterns for displaying data and in turn uses the information to plan and control, a system of management has been created based on the use of information. Two models (Figs. 3-1 and 3-2) visualize those three basic concepts which constitute a management information system.

THE SIX LEVELS OF MIS



(Source: Paul Siegal; Strategic Planning of Management Information Systems, p. 30)

Figure 3 - 1

ORGANIZATIONAL INTEGRATION AND USE OF A MANAGEMENT INFORMATION SYSTEM

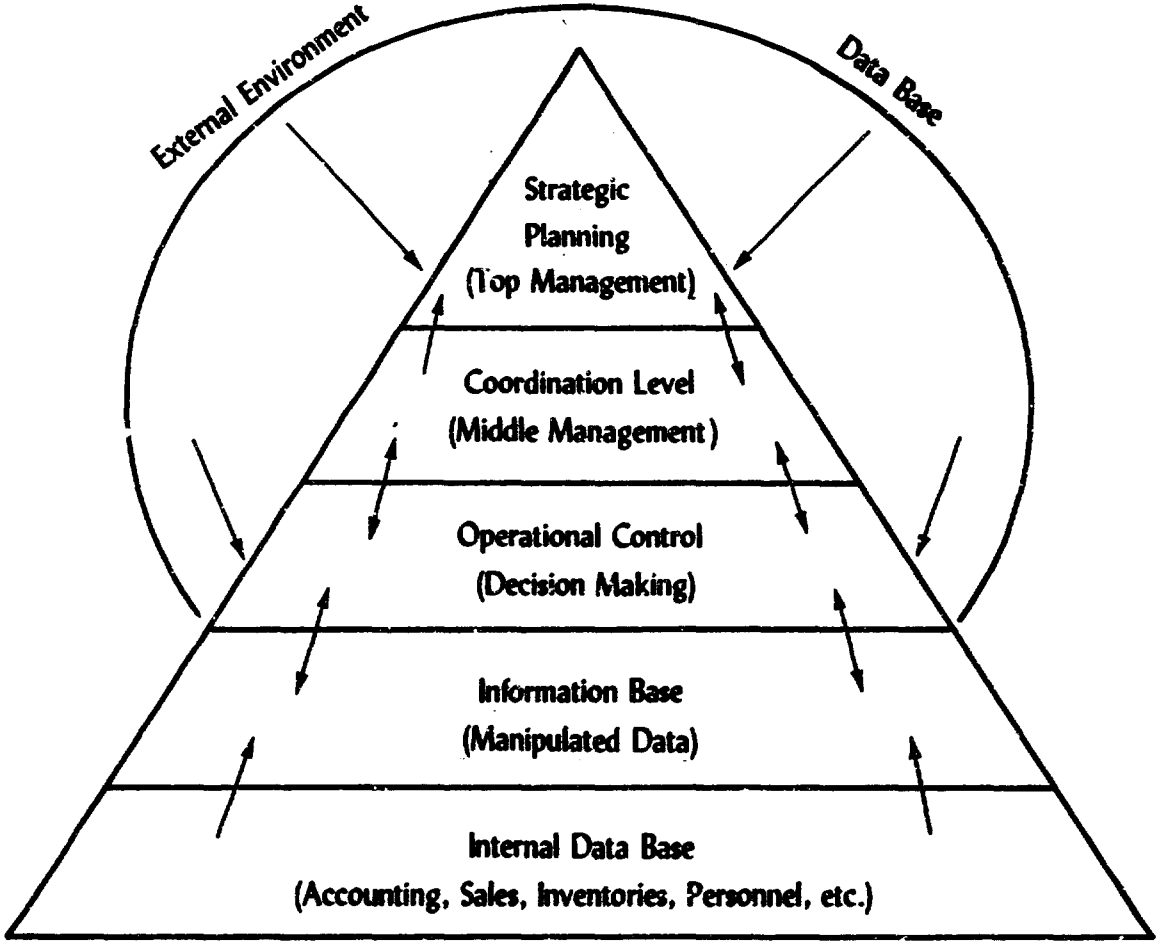


Figure 3 - 2

The purpose of this discussion was to focus on the point of this paper by defining a management (sic, hospital) information system, and making a crucial point on strategic planning for the implementation of a hospital information system. If hospital top management fails to purposefully establish patterns for displaying data, and thus, create information required to manage (plan and control) the activities of the hospital, the very best strategic planning process for implementing a hospital information system will ultimately fail. It will fail because the information provided from the system after it is in place and operating will not be used, since it was not patterned according to the needs of management. Eventually, as the costs of operating the system grow, the value of the system will be challenged. Resources will be cut or withheld and, as discussed in the introduction, Stage II of growth will be clipped (see Fig. 1-1).

An assumption of this paper is that the purpose and use of information generated by any information system has been carefully and thoughtfully patterned long before a strategic planning system is established to implement a management information system. A second assumption for the balance of this paper is that computers will be employed in the capture, storage and manipulation of data and used to generate the information in the patterns prescribed by management. Any following discussion of management information or hospital information systems assumes automation.

Why

Perhaps the question in the reader's mind at this juncture is "Why have a management information system at all, let alone a strategic plan for implementing one?" The literature suggests that the answer is

somewhat similar to the "chicken or the egg" type argument, or the economist's argument of demand creating supply or vice versa.

There is evidence everywhere to document that changes are impacting on our society more rapidly than ever. The rate of change is in itself accelerating. Change affects all individuals and institutions. The ability to perceive and manage change becomes a key to survival. Perhaps the demand to survive has created the supply (of automated) information systems. Others would argue that the rapid increases in computer technology, accompanied by an equally rapid decline in price, have created a supply (capability) of information and generated a demand from management.

In the past, those responsible for decision making in an organization could comfortably forecast the future and not envision substantial change in the methodology of their activity. The advent of the electronic computer dealt the first rude blow to the comfortable feeling that in the systems realm, as elsewhere in the business, things were likely to be much the same in the future as they had been in the past. Today, with a proliferation of techniques and tools for information systems a reality, managers not capable of introducing a more disciplined planning approach into their area of responsibility are ill-prepared to manage in our rapidly changing environment.

> We pay a heavy price for failure to plan adequately. A considerable fraction of the less successful information systems undoubtedly suffer from poor planning and follow-up. Problems of mismatch between information needs and system capabilities will not be eliminated by the best of planning, but good planning will certainly mitigate the consequences of changes in the technology, the environment, and the organization itself.[2]

As to the "Why plan strategically for a management information system?" several of the reasons that follow are sure to fit any particular situation. All organizations large or small, commercial or public-service,

have experienced an increased demand of resources allocated to information processing. More than just additional dollars for personnel, equipment, and software, automated information systems have permeated further and further into the mainstream of the organization's operations to the basic process of managerial decision making itself. Information systems are no longer restricted to traditional transaction processing applications such as invoicing or payroll. They now command other more complex and potentially more costly application areas.

Accompanying the growth in scope and importance of information systems has been a heightened concern by top management for the effective use of systems technology. The growing demand for additional resources to support information systems is only part of the picture. There has also been a growing understanding of the true potential of systems technology and the contribution it can make to the attainment of institutional objectives. As new managers ascend the organization's hierarchy, more and more chief executives will be found to have backgrounds imbued with systems concepts and managerial styles that are compatible with quantitative methods.

Given this newly emergent organizational climate, it has become evident that better systems planning is needed. In the negative sense, such planning helps assure that resources will be applied in the future in a near optimal manner and the systems development failures which traumatized many organizations in the past will be avoided. In a more positive vein, strategic planning for information systems helps select projects that offer the greatest future benefits to managers and other users. Such projects will extend the role of computer-based systems into vital facets of both policy level and operational management.

Strategic planning for information systems seeks to assure that the organization will be in a position to take full advantage of emerging equipment and software technology in satisfying requirements throughout the planning period.[3]

> Despite growing maturation of information processing and heightened interest in strategic planning, there is as yet little recognition of systems planning as a discipline or major sub-discipline within the professional community of computer managers and specialists. There is also a dearth of literature devoted to information systems planning, and what is available does not reveal a real concensus as to the nature and scope of this form of planning activity.[4]

With that quote as a precursor, let us examine the literature that does exist and seek to identify the common components, much as was done in the previous chapter.

Systems Approach

Environment

As might have been surmised from the discussion thus far in this chapter, the organizational environment must be supportive of the need to strategically plan for a management information system. It must, for whatever reason, positive or negative, perceive the need for planning. If not, and the need does in fact exist, or at least is perceived at the operating level, then the first task is to create the perception in the minds of top management. Unless a perception of need is established, and the ensuing commitment obtained, little hope for follow-up productivity or success exists. Verbal commitment without physical action is not enough. Top management must perceive, commit, and initiate action by obligating resources to the planning effort. Further, it is unlikely that the entire organization will perceive the need equally. It may,

like strategic planning, require the creation of a nurturant and forceful internal environment to get all resources moving in the same direction with similar momentum.

Inputs

To document commitment and initiate the momentum, top management must first establish specific goals and objectives relevant to strategic planning for a management information system. In so doing, input is provided as a component to the planning system.

Goals and objectives must be established which in broad terms indicate where the organization wants to go with regard to initiation, expansion and growth of the management information system. Frequently, such goals address the extension of the mangement information system into new areas of the organization to capture more data sooner and, thus, improve the reliability and currency of information. Other goals may simply extend automated capability into existing manual data bases (linking) to achieve greater integration of data processing.

The scope or character of goals must meet the same established criteria discussed in the strategic planning chapter, and the reasonable appropriateness suggested earlier in this chapter for creating any management information system, automated or not (predetermined pattern), useful to the performance of top management fundamental responsibilities, planning, and control.

Perhaps more important than in strategic planning, the method of establishing goals and objectives must involve middle management and users. Those who will be responsible for implementing the output of the management information strategic planning process will also ultimately be the users of the information generated after management issues

operating orders based on information provided by the system. Users must be involved from the start if they are to be reasonably expected to understand and comply at the end. If participative techniques do not already exist within the management structure, they must be established at least in the area of strategic planning for a management information system.

Technical experts in computer systems must also be involved in the formulation of goals and objectives. The variety of hardware architecture and evolution in computer technology requires their involvement to insure that goals and objectives are reasonable, appropriate, and achievable. If expertise is not available within the organization, then their judgment must be contracted.

The planning structure element of the input component must be developed with comensurate regard to participate involvement. It would not be inappropriate to identify many of the same individuals who participated in establishing goals and objectives as members of the planning structure. The range of variables in planning a management information system is further compounded by the infinite variety of computer sophistication. Accordingly, the range of experience, responsibility, and expertise committed to the planning structure is critical if appropriate alternatives are to be identified and sequenced.

Because of the complex, technical nature of a strategic planning process for management information systems, provision for extended periods of dedicated, structured time is fundamental in establishing the planning structure. Regardless of the ultimate methodology (committee, group, staffing) employed by the planning structure, frequent periods of dedicated, extended time must be committed.[5]

Before moving on to the next component, it is relevant to step back and look at where this research has led so far. The applicability of a general system theory approach to this research is emerging. That theory holds that all systems (i.e., strategic planning, management information) have common concepts, characteristics, and components, and are holistic. While a system is a unique entity, its components interrelate and interact with the environment. The complexity of components among systems varies with increased sophistication of the system, but basic patterns do not. Everything a manager does deals with or among systems. The fact that all systems can be broken down to basic patterns, and look and act the same way, enhances management's ability to manage. The trick is to identify any given set of variables as a system, and then proceed accordingly. Proceeding accordingly, let us identify the remaining pattern of variables within a management information strategic planning system.

Feedforward

The increased sophistication is evidenced by the next component, that of feedforward. In addition to the environment forecasting discussed in Chapter II (social, political, economic, technological), management information system strategic planning requires forecasting in two additional areas.

First, the future demand for information at each level of operation must be identified, preferably in objective detail, but certainly probabilistically. The more accurate the forecast, the more likely the outcome of the process is to fit the needs of users. The alternative consequences are either a system that is not comprehensive and integrated, or worse, an under-utilized system which results in wasted costs

associated with implementation and operation. A system of this nature generates numerous reports that no one really asked for, nor is anyone sure what to do with the information!

The second area of forecasting is called a requirements forecast. Simply stated, not everyone who would like a computer requires one. Many processes which generate data, even when integrated into the information base (Fig. 3-2), function very efficiently manually. Requestors may seek to justify requirements based on savings of time or people, but that may not be a cost-effective benefit.

These two areas of forecasting unique to management information systems strategic planning require the technical expertise of computer personnel, usually system analysts. The forecast can be done outside of the planning system and provided to the planning structure, or a sub-element of the planning structure can be tasked to provide this element of the feedforward. The latter is probably better since it involves the necessary personnel and their expertise directly in the planning system, enhances the necessary participatory aspect of planning, and assures the planning structure continual access to this expertise resource.[6]

The increased sophistication (complexity) of management information system strategic planning is further evidenced by two additional elements of the feedforward component.

The planning structure must be provided an inventory of current computer applications. This information should be readily available within the appropriate staff element of the organization. If not, an inventory of both hardware and software applications must be completed. The inventory should be provided in a non-technical, descriptive format giving essential features and capabilities of existing hardware. It

must describe the content of existing application programs operating routinely on that hardware. The format used for system documentation routinely written by programmers should be avoided as being too technical for the average planning structure participant. Perhaps the axiom, "It's hard to know where you're going if you don't know where you are," best justifies the need for a current, comprehensive applications inventory.

Technological forecasting is the final element in the feedforward component, and is perhaps the least difficult factor with which to contend. Within a five-to-seven year planning period, major technological developments in equipment and software can be fairly readily anticipated. This is becoming increasingly so as major manufacturers introduce new computer hardware. Unlike past announcements in which new computers rendered earlier equipment obsolete, most manufacturers now assure that new products are compatible with earlier models in order to protect existing customer bases. Users can have confidence that their existing inventory of computer software applications will operate on future hardware even though they may not exploit all of the new hardware and software features.

Virtually all new innovations, whether processors, storage devices, or terminals, that will come on the market during the five-to-seven year planning period will be in the product planning or engineering stage. Some manufacturers will talk willingly about their research and development efforts while others are more guarded in discussing product features prior to public announcement. Independent research firms and consultants who follow the computer industry can be

consulted for very reliable forecasts of future configurations and prices. Many of these studies go beyond technology to deal with marketing strategy, government policy, and other matters to give their clients valuable insights into new products and services.

All this does not mean that there are not uncertainties in forecasting changes in computer technology. There will always be uncertainty about which potential new products will gain acceptance and prove cost effective and which will not. There will be questions about the suitability of new technology within the systems environment of a particular organization. A hospital in a single city location will have a different perspective on the technology to be associated with the management information system than that of a national manufacturer with dozens of plant sites and hundreds of marketing offices. The forecast should address more than what new equipment and software may be forthcoming, it must be related to the unique problems and requirements of the organization.[7]

Transform

With the content of the input and feedforward components available, the planning structure is ready to initiate the transform component. The necessary elements to complete this component are not significantly different from those identified for strategic planning (Fig. 2-2). However, because of the duality of alternatives to be identified and evaluated (need for information and need for computers to process the information), the process can be expected to take even more time. The literature consistently stresses the iterative characteristics of any planning process, especially when the complex variables of computer technology and information processing are being amalgamated into an automated management information system. Time is further extended when the third valuable,

integrating existing computer inventories into the strategic plan, must be considered in sequencing alternatives.

Though the specific process will and should vary from institution to institution, one literature source provided a universal set of guidelines appropriate to any methodology:[8]

- In large complex institutions, especially where a large application inventory exists, it may be advisable to approach the transform component as a separate sub-system unique to itself. Remember that systems are hierarchical and have a common pattern of components. By doing this, small steps in the overall system plan can be taken rapidly. A sense of achievement is provided to participants, and progress can be observed by top management. Moreover, this will help avoid the pitfall of "ultimate" systems goals that have no immediate objectives or operational subphases. It may indeed be desirable to look ahead to an "integrated, total" management information system, but the attainment of such an ultimate goal should be a step-by-step process which sequences the alternatives so the organization can receive the economic benefits of applications made operational in the immediate future, yet be consistent with the longer range systems goals.
- Alternative plans must be developed for significant trends discerned in the business or technological environment. Consideration of alternatives becomes mandatory in planning beyond a five-year period. Technology forecasts provided as feedforward have a significant impact on structuring alternative systems plans.

- Interface the systems plan with the corporate plan, modifying both appropriately. If there is not an explicitly stated corporate plan, as is still frequently the case in many hospitals, the planning structure must make planning assumptions about the nature of corporate goals. These should be made part of the systems plan.
- Establish a formal mechanism for review and reiteration of the systems plan. Because there must be feedback and interaction among the various contributors to the plan, the planning process is a continuing one. With the rapidity of change so evident in the field of computer technology, modifications will be required, not only because of experience gained within the organization but because of forces at work outside.
- Develop methods for maintaining an inventory of equipment and software and for measuring and projecting utilization of installed equipment. This is necessary so that the useful life of equipment and software can be considered in the systems plan.
- Fix the organizational responsibility for systems planning. In large organizations, there should be a director of systems planning. In smaller organizations the responsibility should be assigned to designated individuals even though this may be only a part-time duty.
- Rotate the assignment of personnel to the planning process. This enables key people throughout the organization to gain new perspectives by exposure to the strategic planning process.
- Budget for technology assessment. This is important in order to permit first-hand evaluation of new equipment and systems

techniques without the pressure of cost justification that is usually associated with approval of new projects or the acquisition of new equipment.

- Document the systems plan in a format intelligible to top management, and arrange for a personal presentation. One of the voids in the relationship between systems people and executive management is that management is typically approached only to gain approval for the acquisition of a particular piece of equipment or to obtain the go-ahead for a certain application project. The system plan, documented in nontechnical jargon and presented to top level management, can give the "big picture" of the systems function and aid in gaining an appreciation of its importance.

Output

The iterative characteristic of the transform component, especially when sub-systemized, may make output a continuous rather than definitive component. If so, the format of the output should be standardized and routinely distributed to all individuals who have a vested interest and/or are required by the nature of the content to take action. As in the output for strategic planning, the output from the management information system strategic planning process must establish performance standards for each assigned action. The standards should be quantifiable, such as dollars obligated or hours committed, and should specify incremential or final completion dates. Control cannot be established without performance standards upon which to measure feedback.

It is difficult to generalize regarding the exact scope and content of an "ideal" strategic planning document. Plans vary markedly from one

organization to another in their coverage and level of detail. Thoroughly articulated plans should contain the following in some form and sequence:

a. Executive Summary

b. Profile of Existing Capability

- Equipment
- Software
- Personnel

c. Assumptions on:

- Policy
- Technology
- Environment

d. Constraints

e. Usage Projections

f. Planning Goals - grouped into logical categories

g. Strategies - including delineation of alternative plans

To this might be added supplementary sections covering objectives that further delineate goals and strategies, along with project plans that provide resource estimates and schedules for achieving each plannned alternative.[9]

Cybernetics

It was stated earlier that the purpose of a management information system was to provide top management information upon which to take action; to plan and control the activities of the organization. Planning and controlling are said to be the Siamese twins of management. So it is with a system for management information strategic planning.

The feedback component of the system must monitor the compliance with performance standards established in the transform (process) component

and provided as output. Feedback, when combined with the dynamic nature of elements in the feedback component discussed earlier, provides the cybernetic characteristics required to control the entire system. Among the cybernetic criteria that should be used to effect control are revelance of information provided to solve problems, versatility in growth and flexibility, accessability, dependability, accuracy, efficiency, sensitivity, suitability, and availability. If feedback indicates significant deviation from established performance standards, then each component of the entire planning system needs to be reevaluated.[10]

As was true for cybernetic control of a strategic planning process, avoid fixing the first deficient element or component found. Use the systems approach to reevaluate the entire planning system and take action only when the effect on the entire system is known.

To this point this research paper has used general system theory to identify and discuss the common components of strategic planning systems (Chapter II) and management information strategic planning systems. A noted increase in sophistication and complexity from the prior to the latter was attributed to the duality involved when considering both management information systems and computer applications within the content of a strategic planning system to implement computer-supported management information systems. Fig. 3-3 provides an analysis matrix of components and elements in common between the two systems which clearly points out the increased complexity and duality. A systems model (Fig. 3-4) depicts the components in their sequencial order.

STRATEGIC PLANNING AND MANAGEMENT INFORMATION

STRATEGIC PLANNING SYSTEMS

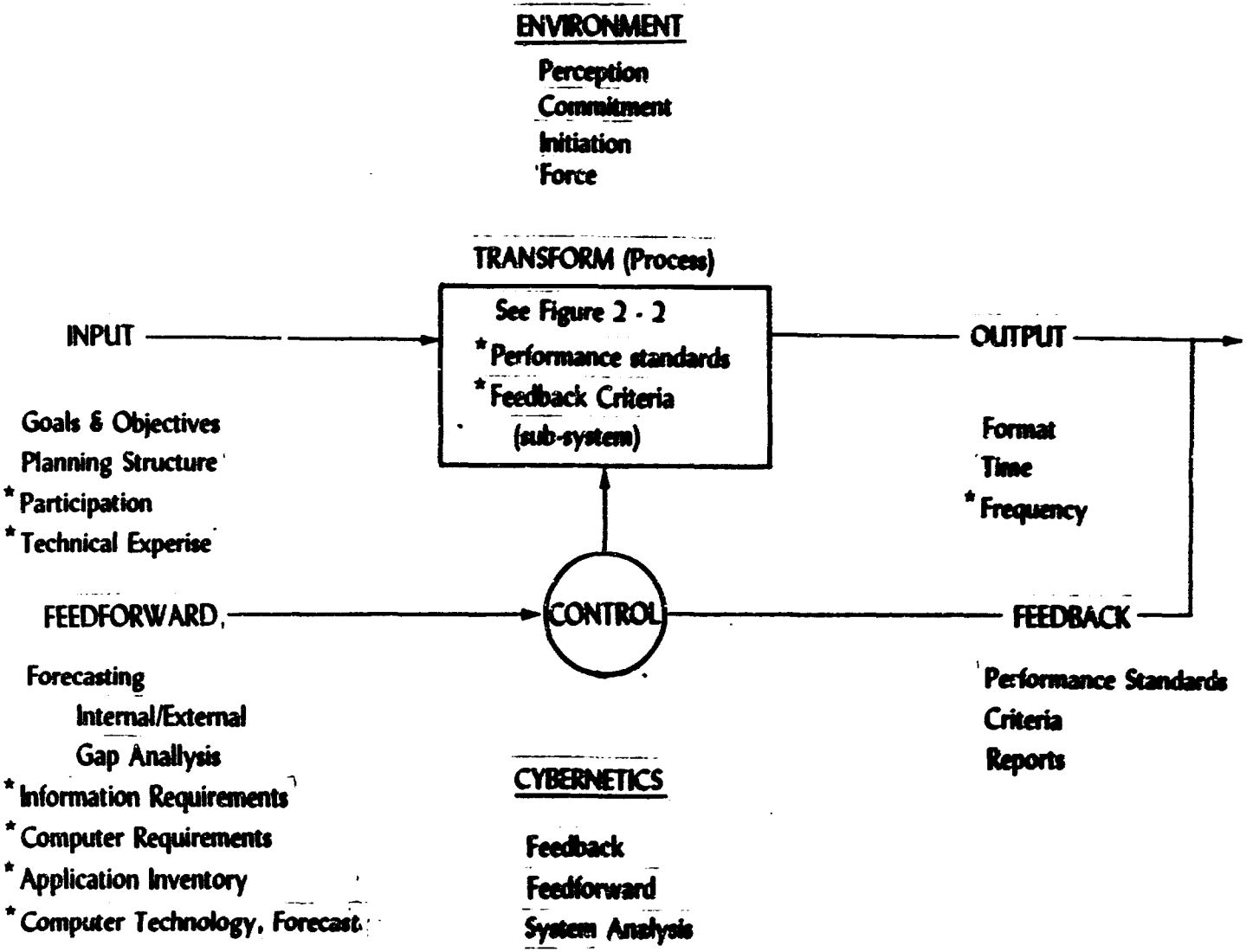
DATA ANALYSIS MATRIX

COMPONENTS	ELEMENTS	STRATEGIC PLANNING	MANAGEMENT INFO SYSTEM
Environment	Perception	X	X
	Commitment	X	X
	Initiation	X	X
	Force	X	X
Inputs	Goals & Objectives	X	X
	Reasonable	X	X
	Appropriate	X	X
	Precise	X	X
	Quantifiable	X	X
	Challenging	X	X
	Achievable	X	X
	Linking	X	X
	Planning Structure	X	X
	Who	X	X
	Time	X	X
	How	X	X
	Participative		X
	Technical Expertise		X
Feedforward	Forecasting	X	X
	External Environment	X	X
	Internal Environment	X	X
	Gap Analysis	X	X
	Information Requirements		X
	Computer Requirements		X
	Application Inventory		X
	Hardware		X
	Software		X
	Computer Technology Forecast		X
Transform (Process)	Alternative	X	X
	Evaluation	X	X
	Time		
	Course of Action	X	X
	Sequence Alternative	X	X
	Written Document	X	X
	Performance Standards		X
	Feedback Criteria		X
	(Sub-system)		

COMPONENT	ELEMENTS	STRATEGIC PLANNING	MANAGEMENT INFO SYSTEM
Output	Content	X	X
	Format	X	X
	Time		X
	Frequency		X
Cybernetics	Feedback	X	X
	Performance Standards	X	X
	Criteria	X	X
	Reports	X	X
	Feedforward	X	X
	Systematic Analysis	X	X
	Action (Control)	X	X

Figure 3-3

MANAGEMENT INFORMATION
STRATEGIC PLANNING SYSTEM



* Additional Elements (See Fig 2 - 3)

Figure 3 - 4

Footnotes

[1]See Paul Siegal, Strategic Planning of Management Information Systems (New York: Petrocelli Books, 1975), p. 30; George A. Steiner, Top Management Planning (New York: MacMillian Pub. Co., 1969), pp. 513-516; James C. Emery, Organizational Planning and Control Systems (New York: MacMillian Pub. Co., 1969), pp. 13-19; and Robert V. Head, Strategic Planning for Information Systems (Wellesley, Mass: Q.E.D. Information Sciences, 1979), pp. 83-86.

[2]Head, Strategic Planning for Information Systems, forward.

[3]Ibid., pp. 3-4.

[4]Ibid., p. 4.

[5]See Head, Strategic Planning for Information Systems, pp. 20-35, 56-59; Leonard I. Krauss, Computer-Based Management Information Systems (New York: American Management Association, Inc., 1970), pp. 40-59, 256-261, 266-268; Siegal, Strategic Planning of Management Information Systems, pp. 162-171; and Arnold O. Putnam, Management Information Systems (Boston: Herman Publishing, 1977), pp. 54-61, 70-73, 95, 126-127, 160-161.

[6]See Head, Strategic Planning for Information Systems, pp. 67-69, 72-78; and Krauss, Computer-Based Management Information Systems, pp. 72-75, 149-220.

[7]See Head, Strategic Planning for Information Systems, pp. 12-17, 62-67, 69-71; and Krauss, Computer-Based Management Information Systems, pp. 220-222.

[8]Head, Strategic Planning for Information Systems, pp. 99-102.

[9]Ibid., pp. 86-99.

[10]See Head, Strategic Planning for Information Systems, pp. 83-86; and Krauss, Computer-Based Management Information Systems, pp. 24-28, 102-103.

CHAPTER IV

HOSPITAL INFORMATION STRATEGIC PLANNING SYSTEM

Why

Admittedly, the environment in which a health care delivery system exists today is not an easy one in which to function. There are rapid yet undefined major changes taking place in the political, social, economic, and technological elements. Managers are continuously challenged to make long-range commitments under extreme conditions of uncertainty. The value of information upon which to reduce the risks of decision making is at a premimum. The need for a responsive, comprehensive, reliable system to provide information is ipsofacto.

The literature base of this research paper consistently pointed to a systematic approach to problem solving as the single most important concept if hospitals are to successfully manage the impending changes and survive.

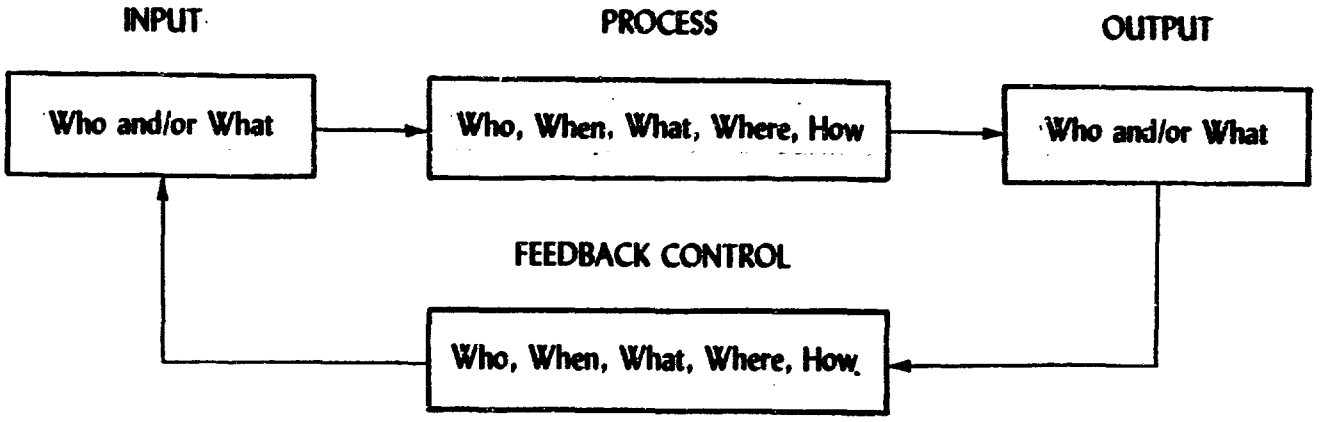
The need for systematic planning was the subject of hospital literature and professional journals more than ten years ago. Planning was stressed as the means of adapting to political and economic change. It was anticipated then (and is true today) that the resources required to structure and operate a delivery system in the future would require extended periods for marshaling. We see today that a period of six to ten years to plan, build, and open a new health care complex is not unusual. The resort to techniques of long-range planning was said to be the only means to an end of efficient delivery of modern health care.

The literature of the seventies presented many versions of an open, general system approach to planning. The theoretical approach to the research by the author can be seen in the systems planning models synthesized from the literature of this period, provided in Figures 4-1, 4-2, and 4-3.[1] The point is simple. The idea of system planning for hospitals is not a new concept.

Recent literature discusses the need for the amalgamation of the two earlier concepts, information systems and systems planning. During the last ten years, hospitals have become increasingly complex organizations to manage. Social expectations for more sophisticated patient care, using more complex techniques have been pitted against political and economic expectations to maintain hospital cost within strictly defined limits. The literature advocated the systems approach as the best management tool for dealing with these divergent forces. A systems approach effectively operates across multiple organizational lines, addresses conflicting objectives and reconciles the diverse needs within a hospital. When applied to the establishment or upgrade of a hospital information system, the systems approach may be the only viable technique to reconcile the diverse needs of clinical, ancillary and administrative entities within a hospital.[2] The lack of such an approach is attributed as being the cause of failure by most hospitals to develop fully integrated information systems. As a result, a large number of information systems have developed incrementally into a multitude of separate systems with duplication of input and output, and worse, frustrating gaps in information required by today's hospital administrator.

In turn, administrators have restrained resources required for the growth and maturation of hospital information systems creating the clipped

DESCRIPTIVE PARAMETERS OF OPEN SYSTEMS



(Source: William G. Akula; Jay A. Vora, "System Planning Tomorrow Hospital Today", Management Planning, (Jan/Feb 1972, p. 88)

Figure 4 - 1

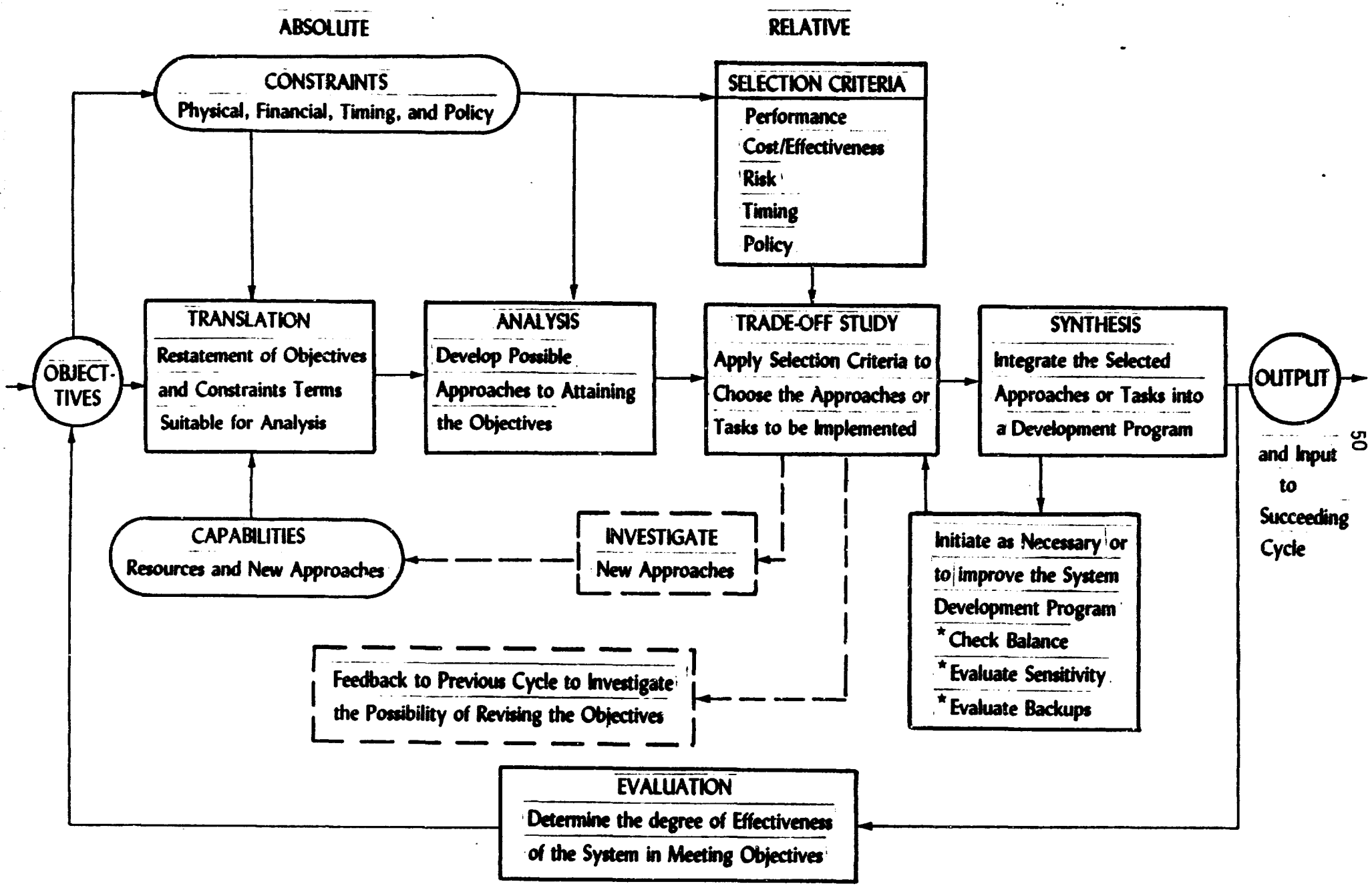
STEPS IN THE SYSTEMS APPROACH

STEPS	LONG-RANGE HEALTH CARE PLANNING (Any level of congizance)
I. Objectives	Establish the broad objectives
II. Constraints	Set forth the constraints Existing needs and demands Planning at other levels Present levels of care Projected needs and demands Manpower Existing facilities Financial Demographic Population characteristics Timing Existing policy
III. Translation	Restate refined objectives in consideration of constraints
IV. Analysis	Develop possible approaches to attaining the objectives, with each approach being stated in terms of: Who When What Where How
V. Selection Criteria	Set forth the criteria for the selection of an approach: Total cost Performance or results Cost/Effectiveness Timing Risk Policy Avoidance of untoward consequences Flexibility
VI. Trade-Off and Synthesis	Apply selection criteria to the possible approaches. Integrate the selected approach or approaches into a system model or development program.
VII. Cycle Output	After final testing and evaluation, specify and adopt the plan.

(Source: William G. Akula and Jay A. Vora, "System Planning Tomorrow's Hospital Today," Management Planning (Jan/Feb 1972), p. 88.

Figure 4-2

STEPS WITHIN SYSTEMS APPROACH



(Source: William G. Akula; Jay A. Vora, "System Planning Tomorrow Hospital Today", Management Planning (Jan/Feb 1972), p. 88)

Figure 4 - 3

Stage II development of a total system (see Fig. 1-1).[3] The only practical solution to this unsatisfactory, incremental environment of hospital information systems is the use of a strategic planning system specifically designed for implementing a hospital information system.

What

A significant part of the problem in developing a computer-based, fully-integrated information system within a hospital is the variety of computer systems and applications that already exist. The American Hospital Association classifies the wide variety of systems and services into six functional categories. Terms such as "Medical Information System," "Health Information System," Hospital Information System," are all used throughout the contemporary literature to describe and discuss the same concept: a planned, structured, computer-support system within a hospital to capture a variety of data, process it according to pre-established patterns of information, and then provide it to hospital top management in a timely fashion for use in planning and controlling hospital operations.[4] The relatively simple flow in a management information system (Fig. 3-2) can be seen when compared to the complexity of information flow which originates from the variety and vastly different data bases in a hospital (Fig. 4-4). The point here is that the conceptual understanding of what is to be planned and implemented is more important than universal agreement on one definition. For the purpose of this research, that concept is called a hospital information system (HIS).

Whereas the research for Chapters II and III of this paper provided a variety of sources for establishing a strategic planning system or a

DATA FLOW AND ORGANIZATION INTEGRATION IN A HOSPITAL INFORMATION SYSTEM

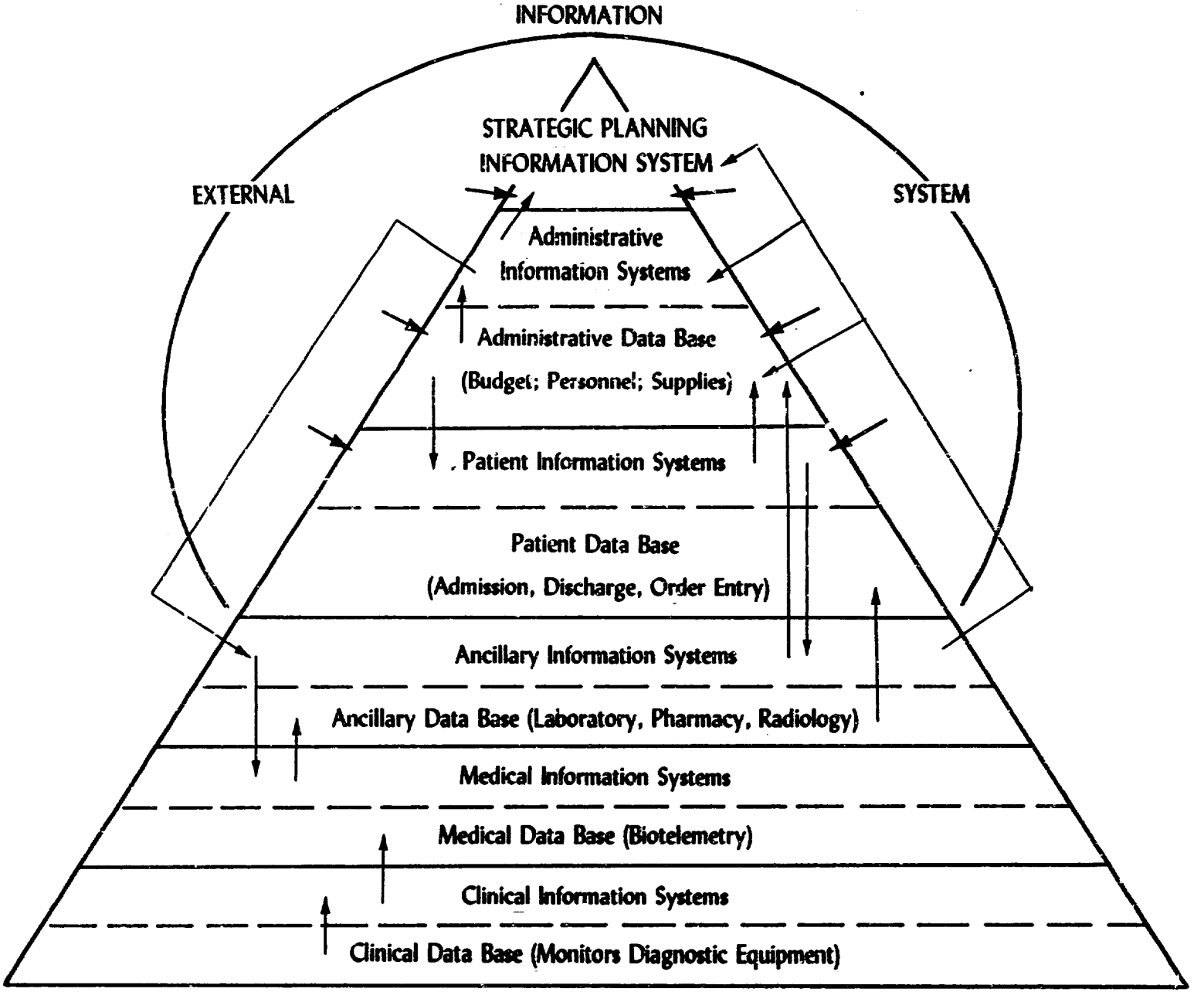


Figure 4 - 4

management information system, the discovery research into literature on strategic planning for hospital information systems was less than productive. Although a variety of authors discuss at length the evolution and cause of the current (lack) state-of-the-art in hospital information systems and urge long-range planning to achieve full integration and maturation (Stage IV, Fig. 1-1) of existing incremental, partially developed systems, nothing was found on how to do exactly that. Assessment of the literature using the basic premise of the paper, the general system theory approach, did, however, serve to pull much of what has been randomly published into a pattern of common components.

Systems Approach

Environment

The discussion thus far in this chapter has inferred many of the elements which must and do currently exist in the environment, conducive to initiating a hospital information strategic planning system. The principle element of perception (of need) must exist. The impacting political, social, economic, and technological forces on hospital administration must create a need for better information upon which to plan and control. Concomitantly, there must be a stimulating dissatisfaction with the existing information system. Frequently, the source of this stimilus is the same source which precipitates the abbreviated growth in the Stage II of automated data processing systems in hospitals (Fig. 1-1).

The elements of commitment, initiation and force are even more vital than previously discussed. The organizational, technological, and multi-disciplinary complexities, combined with duocratic management

structure of hospitals, mandates a solid, bilaterial commitment by both administrative and clinical managers; vigorous, well-publicized initiation of the system; and sustained force throughout the organization. The covert nature of vested interests, parochialism, and disassociation with institution-wide values found in most hospitals, especially in the Not-for-Profit sector, must be overcome by creating an environment where support of a strategic planning process is the best way, the only way, for the individual to get his or her needs (information) met. The environment must be continually monitored to ensure that it is conducive and supportive.

Input

A hospital information system is built on both administrative and clinical data bases (Fig. 4-4). Goals and objectives must be established for both clinical (scope, level, amount of service provided) and administrative (information needs) areas. The first step in identifying goals and objectives may well be the need to first define the overall goals and objectives for the hospital. The ultimate purpose of the hospital information system will be to provide the information required to plan and control hospital activities toward its overall goals and objectives in the community. The most successfully implemented information system will fall short of expectations if it is not strategically planned to meet those needs. Remember that systems are hierarchical, and must function congruently to attain both efficiency and effectiveness.

The diversity of needs for information has been suggested in Fig. 4-4. Participation in the planning system must, therefore, incorporate representatives from all areas of need into the planning structure element of input. Perhaps the only possible way to ensure

the continuance of a supportive environment and overcome the inherent nature of hospitals discussed earlier, is through such incorporating representation.

The participation of technical expertise is equally essential. The rapid advancement of computer-based medical technology, in addition to the complex, in many cases as yet unresolved, technical obstacles of compatibility and integration of individual computer applications, necessitates the constant judgment and involvement of the best automation management and computer system personnel available. Without them, the sequencing of alternatives into a strategic plan may not in fact be practical, or implementable for technical reasons.

Time is a critical aspect of the planning structure element, again particularly so in the Not-for-Profit hospital with its privileged, not employed medical staff. Once again, the critical nature of the environment is seen. If time spent in participation is perceived as the only way to achieve need satisfaction, then time will be made available by the participant. Participation will also be enhanced if time is spent in short, yet frequent, intervals. The demands of patient care are such that whether they be hands on, ancillary, or administrative, few participants can affort extended periods of time (days) dedicated to a management information strategic planning system.

The <u>how</u> aspect of the planning structure element is perhaps the easiest to determine. Hospitals are a committee-based management process. Committee process is a familiar, comfortable, usually well-managed method of problem solving for most hospital staff members. Therefore, use of a committee process is without doubt the best approach, and quickly integrates the hospital information strategic planning system into the overall management system for the institution.[5]

Feedforward

The complexity and absolute difficulty is quickly reestablished, however, when discussing the elements of feedforward. Forecasting the external environment for a health care institution has become a virtually impossible task. Since most hospitals are dependent on government subsidation for economic survival, the volatile nature of the political aspect of forecasting is at once critical, and recently, impossible. Reliance on the principle that it is better to be approximately right than precisely wrong is perhaps the best argument to advance. More objectively, the use of operations research techniques can significantly improve the reliability of forecasts.

The duality of forecasting both information needs and computer needs is also existent in hospital information strategic planning systems. It may be even more difficult since users are frequently sensitized to spending large dollar sums for relatively small, highly sophisticated, diagnostic technology. The idea of a few thousand dollars for a computer component to support an aspect of the hospital information system may distort the objectivity of need for either the information to be generated or the cost effectiveness of the automated equipment to generate it. Fully documented justifications for each forecasted need must be established as a reliable element of feedforward. To the extent they are not, future costs of acquisition, implementation, and operation will most certainly exceed the benefits.

An inventory of both clinical and administrative computer applications is the next required feedforward element. If one does not exist, this will be a time-consuming activity. In most hospitals today, computer application and usage have proliferated. The generally reduced cost of

small systems may have precluded the normal procurement process, dependent on delegation of expendutures authority. It is not uncommon for individuals to use personal systems in their job place. Regardless, a systematic and complete inventory of existing application of computer hardware and software must be accomplished.

In large hospitals it is advisable to determine a format for documenting each application to facilitate analysis and understanding of existing systems. The fact that most hospitals have up to six different categories of applications further argues the need to standardize the application inventory reporting format. When used during the transform process, the ability to classify alternatives into application groups, and prioritize alternatives within and among categories of systems will facilitate the step-by-step, iterative, analysis-discussion methodology. A predetermined format for documenting existing applications will also facilitate analysis of forecasted user requirements. The continual involvement of appropriate technical expertise (system analysts) in the inventory process is a fundamental requirement.

As discussed in Chapter III, the future technology of computers is expected to be evolutionary, not revolutionary. Although improved data storage and programming techniques are on the horizon (bubble storage), major changes rendering existing equipment obsolete are not anticipated. However, within health care, revolutionary changes in computer applications can be expected to occur. Forecasting these events, these new applications which will enhance clinical capability, or more successfully and completely integrate clinical, ancillary, an administrative applications, is an admitted crystal ball approach, but,

nevertheless, a necessary, and depending on the available degree of certainty, a significant element of the feedforward element.[6]

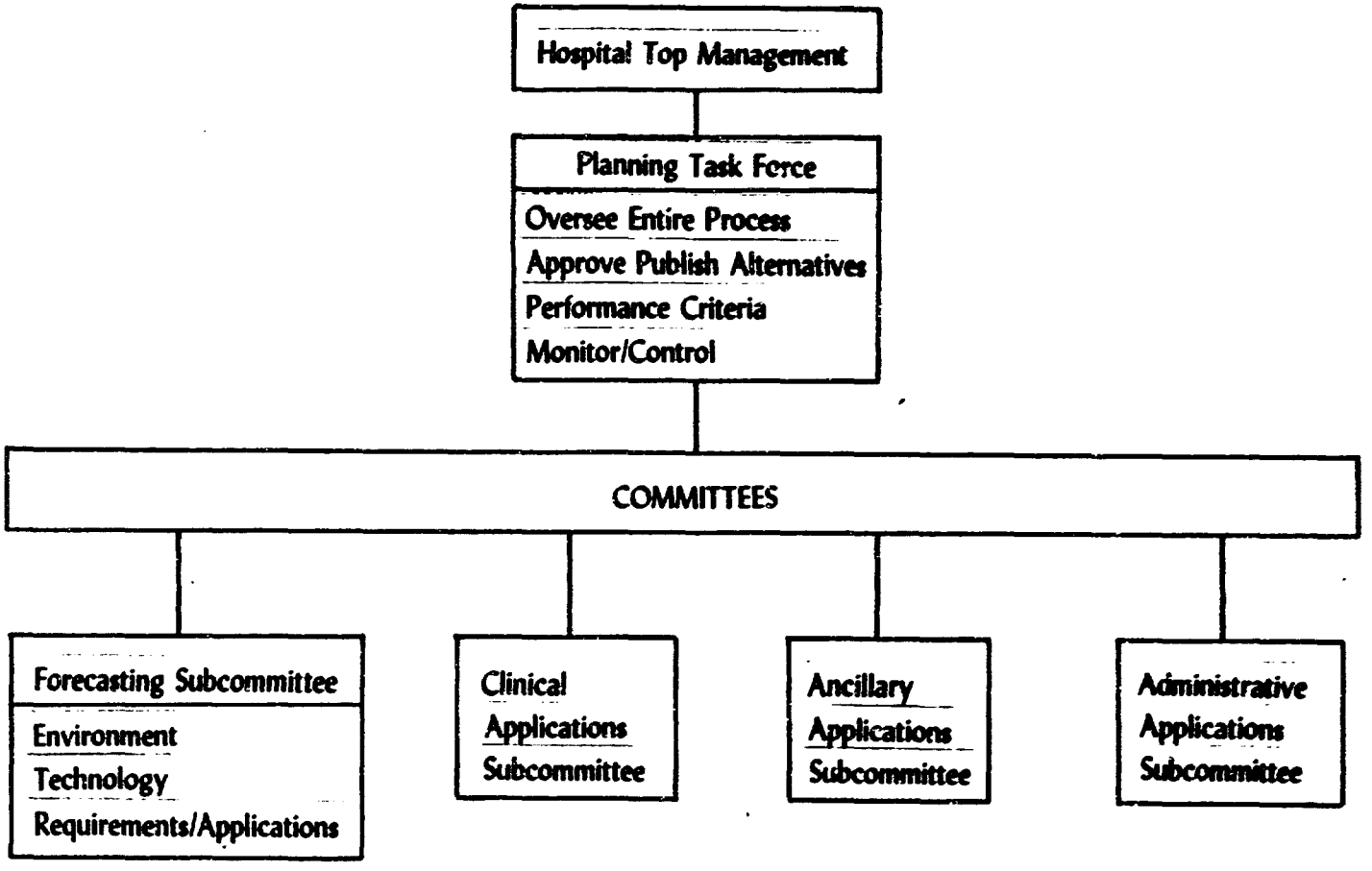
Transform

The ease and rate of progress with which the next component is accomplished, transform, is directly related to the thoroughness with which the supportive environment was created; inputs were clearly, comprehensively and appropriately provided; and the probability and accuracy with which feedforward was provided. Deficiency in any component or element will have significantly adverse effects on the planning process. If the data or information provided is not complete, accurate, and quantified to the greatest extent possible, the iterative, open-system nature of the process will force planning-structure members to cycle back to one of the prerequisite components in search of missing information, data or guidance.

Given the complexity of strategic planning for a hospital information system, the sub-systemization of the transform component is highly advisable. Depending on the size of the institution and the size of the planning structure, alternatives may be more quickly identified and analyzed if a sub-committee approach is taken. In such a case, the planning structure might be designated a Planning Task Force, with several sub-committees assigned specific tasks. One such organizational structure is suggested at Fig. 4-5. A decision process flow diagram for each of the sub-system working committees is seen at Fig. 4-6. Tasks to be performed are basically the identification and evaluation of alternatives. To maximize the progress and benefit of these sub-system committees, it might be advisable to group tasks by categories of alternatives to be evaluated (clinical, ancillary, administrative).

ORGANIZATIONAL STRUCTURE FOR A LARGE SYSTEM PLANNING EFFORT

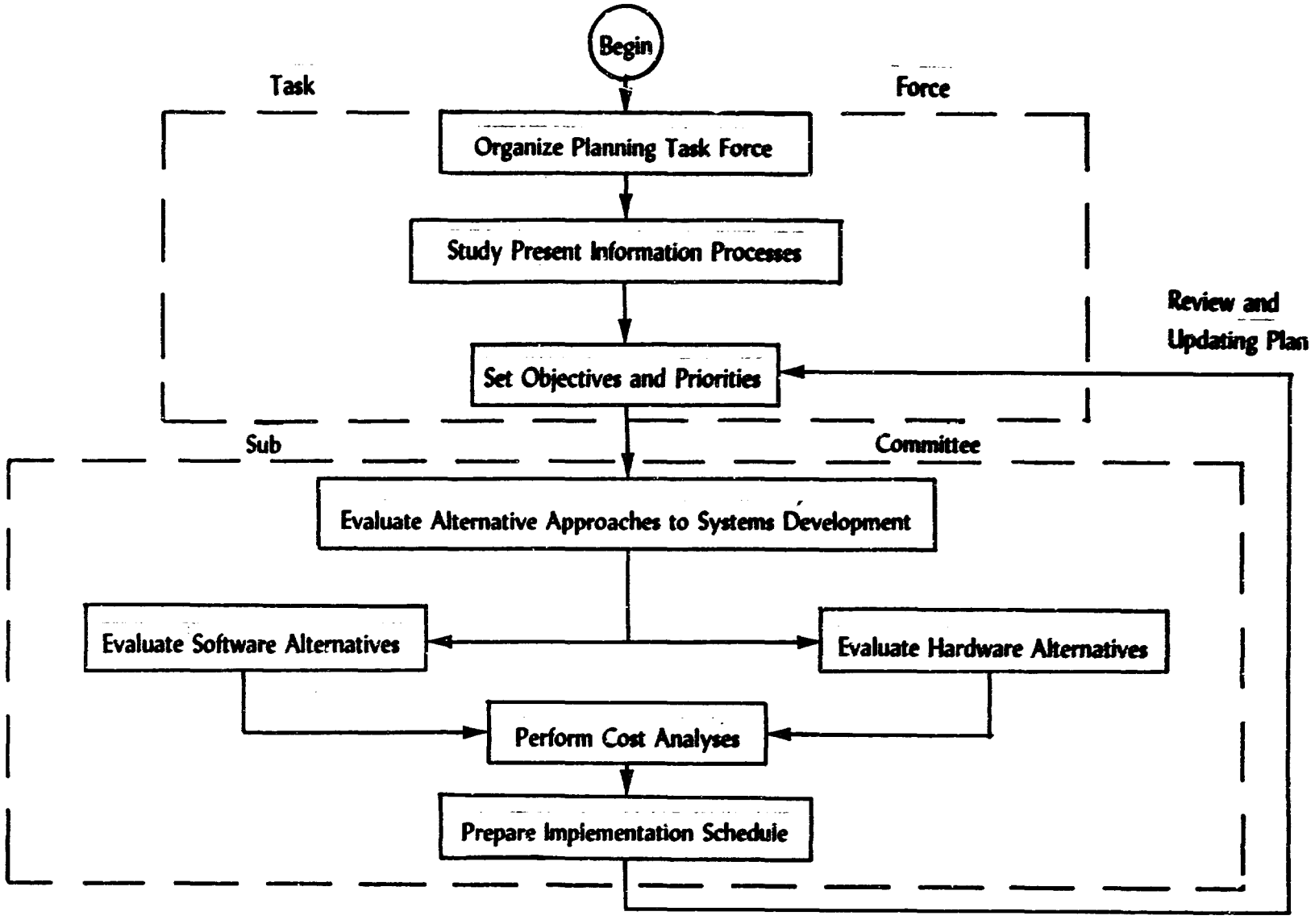
(Sub-Systemizing the Transform Component)



(Source: Adapted from; Charles J. Austin; Information Systems for Hospital Administration, p. 51)

Figure 4 - 5

SUB—SYSTEM/COMMITTEE DECISION FLOW MODEL



(Source: Adapted from: Charles J. Austin: Information System for Hospital Administration, p. 44)

Figure 4 - 6

The process (transform) by necessity must be a slow, deliberate one, and time is, therefore, a critical element. Although it is not possible to give a specific estimate of time for any given hospital, a range of six months to a year of intensive effort would not be unreasonable.[7] Obviously, during such an extended period of time, many acceptable, immediately implementable alternatives will be identified. For that reason, the planning structure should establish a format for the iterative output as it is finalized.

Output

The format of the output, whether for the entire management information system strategic plan, or the issuance of implementable alternatives as they are established, should be designed along the lines of current communication formats used to publish, implement and control policy throughout the organization. Inherent in the content of the output format must be provisions for feedback during both implementation and operation. Each project should have standards established for performance based on criteria used for decision making within the transform component.

The criteria should relate to the overall goals and objectives of the hospital. Accordingly, the incremental and subsequently, the performance of the total, hospital-wide, integrated information system, will provide the information required by top management to plan and control the use of resources required to move the hospitals along the decided path to its institutional goals and objectives. To the extent that performance standard criteria do not correlate to the long-range goals and objectives for the hospital, the hospital information system will not meet the expectations and requirements of top management. Put differently,

the systematically developed information system will provide information neither requested nor used if performance standard criteria are not carefully linked to the larger goals and objectives of the hospital. The specific performance standard criteria will, therefore, vary from hospital to hospital. Put in broad concepts, however, criteria should relate to responsiveness of the information system, economy, and most assuredly, a direct correlation to improvement in patient care.

Cybernetics

The discussion above has suggested the remaining components of a hospital information strategic planning system: feedback and control.

Feedback during implementation and follow-on operation of the hospital information system is critical to control. It becomes even more important when the transform component has been sub-systematized, and alternatives are published (output) on an iterative basis. In such approaches, the open-ended nature of the entire system usually results in a level of activity being carried on in each component, concurrently. Even as alternatives are implemented, changes in the existing and forecasted environment are occurring. Goals and objectives of the hospital and those which pertain specifically to the management information system are under constant assessment and modification. Other sub-system work groups are sequencing alternatives which interface, if not directly impact on alternatives under implementation. Therefore, feedback must be provided continuously, or control will be denied, and the entropic characteristics of management information strategic planning (general) system will most certainly manifest itself. Feedback must be carefully assessed (it is only one component of the system) in each of the three

broad categorical performance areas. For instance, while responsiveness of the total system may improve greatly from the implementation of a single alternative, the performance criteria for economy and improved patient care may not show equal improvement until all or most of the total information system has been implemented. Feedforward elements established earlier, plus the additional feedforward element of known or project impact from other alternatives must be combined into a cybernetic control process. Change anywhere (control) in the system (or sub-system) will have an effect on other elements/components of the system (or at least most of them) to be implemented. Time is required to achieve operating congruance. Act only when the consequences are both predictable and desirable.

Putting It All Together

Five components of a system have been used throughout this paper as the basic format to report reseach findings. In actuality, a cybernetic system is a bit more complex. Five basic components were used to minimize confusion and, hopefully, enhnace understanding. To conclude the research, the basic cybernetic system model will be expanded now to provide the reader with an understanding of a hospital information strategic planning system.

Fig. 4-7 presents a basic general system theory model. To that basic model, this paper added the components of feedforward and control, shown by dotted lines in Fig. 4-7, as a simplified cybernetic system model. The complete cybernetic model is seen as considerably more complex in Fig. 4-8. The additional components of outcome and the distinguishment between positive and negative feedback emanating from outcome deserve special discussion.

GENERAL SYSTEMS THEORY MODEL

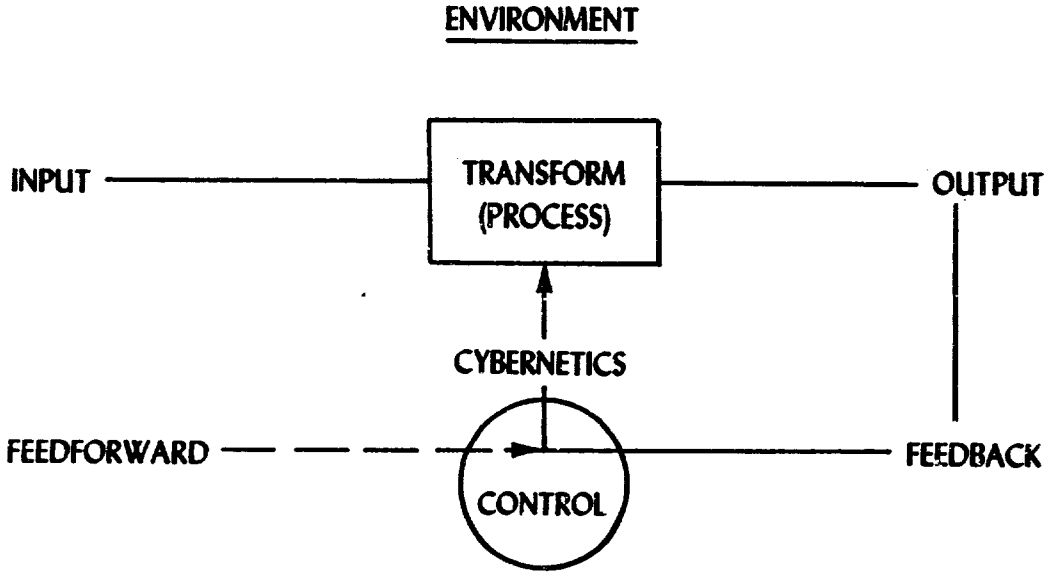


Figure 4 - 7

CYBERNETIC SYSTEM MODEL

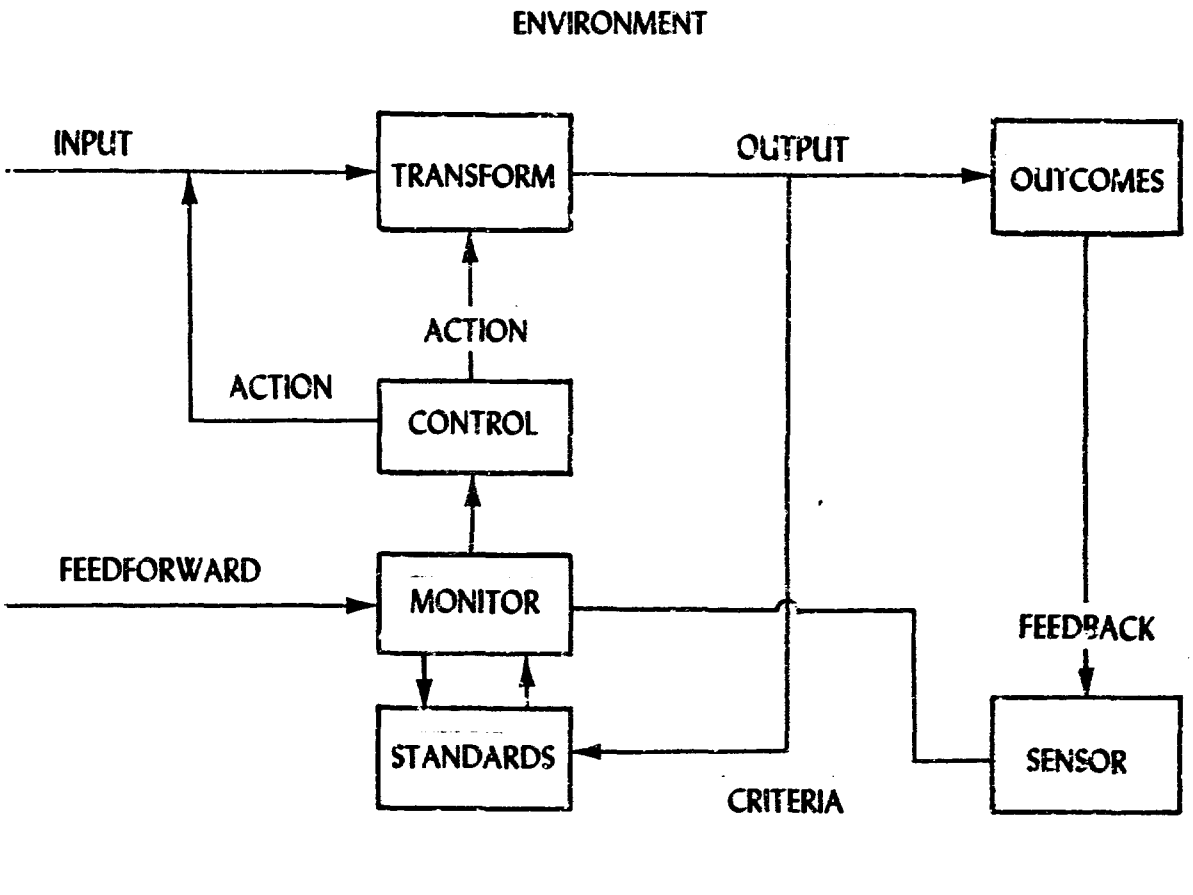


Figure 4 - 8

As hospital information system alternatives are implemented and operated, performance (outcomes) will provide feedback. Operators, users, and middle management, acting as sensors will pass feedback to planning structure members (or top management) who act as monitors of the cybernetic system. Using criteria-based performance standards, monitors should interpret feedback as positive or negative. Action can then be initiated on either the input or transform component, or both, and the action can be either negative or positive.

For instance, positive action may be to issue new goals and objectives, due to the positive results (outcome) of alternatives already implemented. Or, it may be to accelerate the output of additional alternatives from the transform based on the successful implementation of previous output.

Negative action, on the other hand, might be taken to modify, change, or challenge the original goals as too ambitious or lacking relevance. The transform could be slowed down until "bugs" are worked out of implemented alternatives, or the entire planning system may require re-analysis for the various reasons provided in each chapter of this paper.

To put it all together, the content of the hospital information strategic planning system data matrix (Fig. 4-9) is integrated into the cybernetic system model and Fig. 4-10 models an optimal strategic planning process for controlling and coordinating the inhouse development of an integrated, computer supported, hospital information system.

HOSPITAL INFORMATION STRATEGIC PLANNING SYSTEM

DATA ANALYSIS MATRIX

COMPONENTS	ELEMENTS	STRATEGIC PLANNING	MANAGEMENT INFO SYSTEM	HOSPITAL INFO SYSTEM
Environment	Perception	X	X	X
	Commitment	X	X	X
	Initiation	X	X	X
	Force	X	X	X
Input	Goals & Objectives	X	X	X[1]
	Reasonable	X	X	X
	Appropriate	X	X	X
	Precise	X	X	X
	Quantifiable	X	X	X
	Challenging	X	X	X
	Achievable	X	X	X
	Linking	X	X	X
	Planning Structure	X	X	X
	Who	X	X	X
	Time	X	X	X
	How	X	X	X
	Participative		X	X
	Technical Expertise		X	X
Feedforward	Forecasting	X	X	X
	External Environment	X	X	X
	Internal Environment	X	X	X
	Gap Analysis	X	X	X
	Information Requirements		X	X[1]
	Computer Requirements		X	X[1]
	Application Inventory		X	X[1]
	Hardware		X	X
	Software		X	X
	Computer Technology Forecast		X	X
Transform (Process)	Alternatives	X	X	X
	Evaluation	X	X	X
	Time		X	X
	Course of Action	X		
	Sequence Alternative	X	X	X
	Written Documents	X	X	X
	Performance Standards		X	X
	Feedback Criteria		X	X
	(Sub-system)		X	X[2]

COMPONENTS	ELEMENTS	STRATEGIC PLANNING	MANAGEMENT INFO SYSTEM	HOSPITAL INFO SYSTEM
Output	Content	X	X	X
	Format	X	X	X
	Time		X	X
	Frequency		X	X
Cybernetics	Feedback	X	X	X
	Performance Standards	X	X	X
	Criteria	X	X	X
	Reports	X	X	X
	Feedforward	X	X	X
	Systematic Analysis	X	X	X
	Action (Control)	X	X	X

[1]For both clinical and administrative areas

[2]Recommended

Figure 4-9

HOSPITAL INFORMATION STRATEGIC PLANNING SYSTEM MODEL

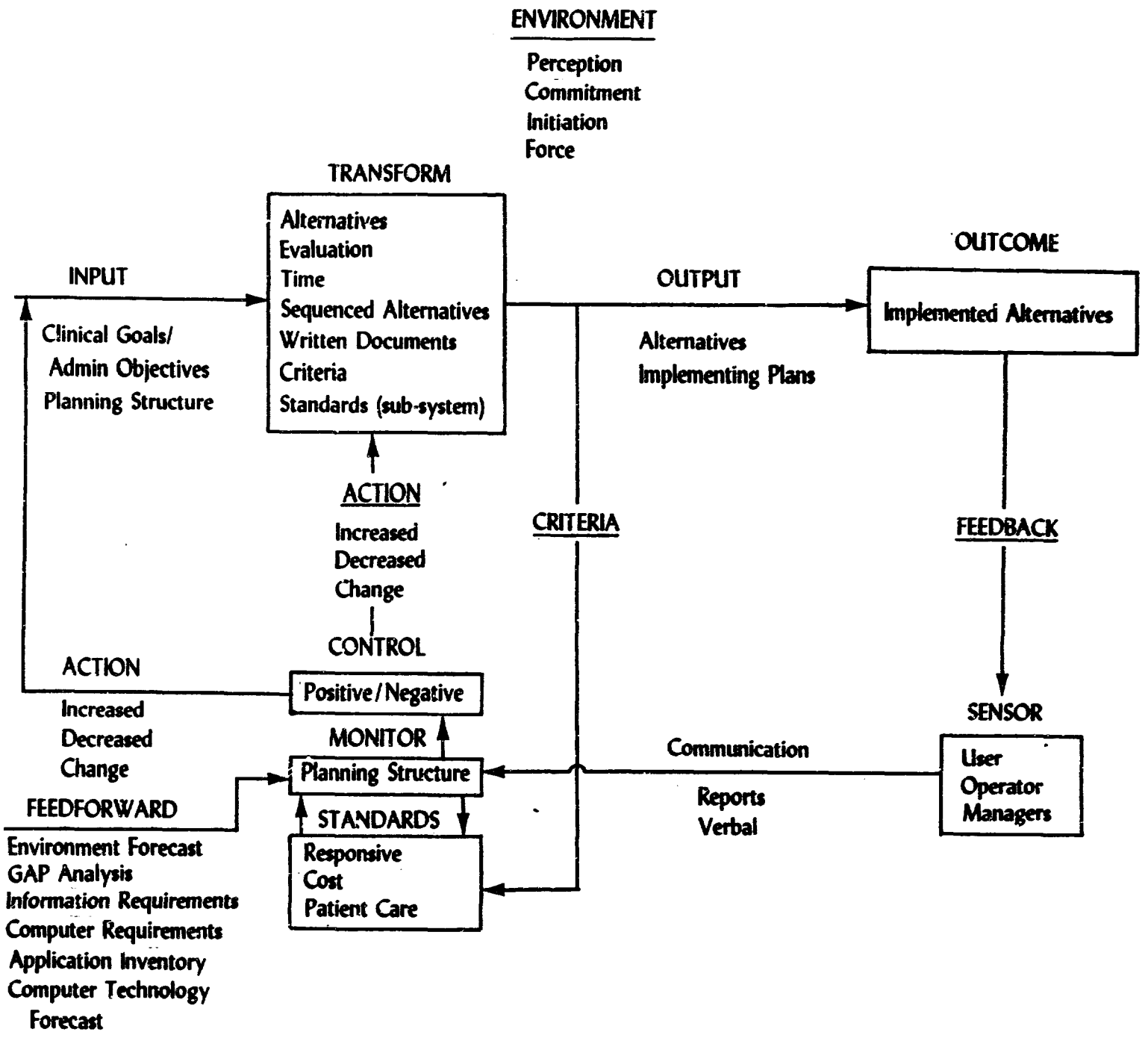


Figure 4 - 10

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

A comparison of the evaluation criteria for this research (Chapter I) with the reported findings will serve to succinctly present several conclusions.

The first criterion stated that a strategic planning process for developing a hospital information system (HIS) must incorporate components commonly used in corporate strategic planning process and industrial management information systems. The literature research presented in Chapters III and IV discussed the common components, and identified their patterns of association as being commonly called a general system theory. Additionally, the content of Figures 2-3 and 3-3 presented the recurrence of these components between the two disciplines. It can be concluded then that the first criterion has been satisfied.

The second criterion stated that a HIS strategic planning process must be integrated into the existing organizational structure and management process. The vital need for user involvement, and integration into existing organizational structures and process was redundantly stated throughout this paper. Conformity of HIS process to organizational process is absolutely essential in insuring a cost-effective, coordinated, used hospital information system. The literature was clear that the planning system will fail or be inadequate to the same degree that that

process is not integrated and institutionalized within each facility. The second criterion was accordingly met.

Next, the need to involve input from top management, prospective users, and technical experts was the third criterion. The discussion in Chapter IV was lengthy on these points. The possibility of sub-systemizing the transform process into generic work groups was presented as a technique to assure compliance with this criterion in very large, especially complex hospitals. Feedforward in the form of user requirements discussed the need for not only technical expertise, but the users, or prospective users, participation in identifying future requirements and possible alternatives to meet those requirements.

The final criterion, incorporation of existing automated systems, technological change and projected organizational needs into an integrated system, was discussed in Chapter IV and modeled in Fig. 4-10. The inherent elements of each component (input and feedforward) presented in Fig. 4-10 satisfy this criterion. The iterative nature of the entire process was also seen as an assurance mechanism providing for the cyclical update and necessary reconsideration of each element of this criterion. It was noted that a fully-integrated system may not be achievable in all institutions. In some cases, the technology does not yet exist. In others, replacement or refurbishment of existing systems may not be advisable from a cost-benefit perspective. Integration was seen to be optimally achievable, not maximally possible.

Having thus reiterated the research criteria and correlated the presented findings, what other conclusions should be drawn?

First, it became painfully obvious that the HIS strategic planning process is a time-consuming, complex task. It is even more so for those

hospitals who have not had a formal management decision-making process heretofore. Strategic planning is not the only way, but it is a highly effective and efficient way to communicate, coordinate, implement, and control the growth of computer applications and systems in the hospital environment.

Next, C&P, commitment and participation, is mandatory for success of the process. Superficial commitment and intermittent, less-than-enthusiastic, participation will assure failure and dissatisfaction with process outcomes.

Recommendations

The design of a qualitative technique to give value (and control) to the hospital information strategic planning system was presented in Chapter I as a secondary, though uncommited, objective of this research. During the course of research, it because obvious that controls for the process must by necessity be tailored to each institutional setting, and that no one universal set of values would be useful.

Use of program evaluation review techniques (PERT) does seem well suited to control of the process, but the time value for any given activity or event will vary from hospital to hospital.

PERT is, therefore, the technique of choice. Users should develop a PERT chart using each of the elements listed in the HIS Data Analysis Matrix (Fig. 4-9) as event nodes. However, activity times from one event to another can only be estimated for any given hospital, and will, therefore, vary individually from event to event, and collectively from start to finish of the process. Remember that six to 12 months was stated as not an unreasonable period of time.

The final recommendation of this research paper comes from the literature upon which it is based. "The short and long range goals of an institution should be defined and integrated into a long range system plan."[1] The hospital information strategic planning system developed by this research and modeled in Fig. 4-10 provides one method to accomplish that objective.

Footnotes

[1]Malcom J. Ball, Ed., and Thomas J. Boyle, Jr., "Hospital Information Systems: Past, Present, and Future," Hospital Financial Management, 34:2 (February 1980): 20.